Inexpensive Word Processors For VIC And 64

COMPUTE!'s GAZETTE

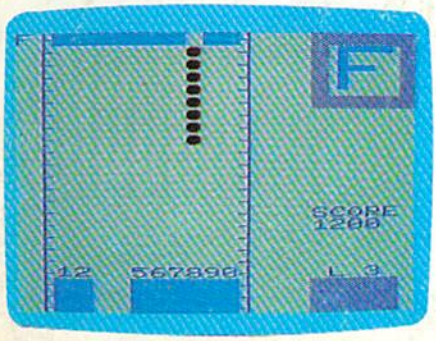
$2.50
October 1983
Issue 4 Vol. 1, No. 4
63380 $3.25 in Canada

For Owners And Users Of **Commodore VIC-20**™ And **64**™ Personal Computers

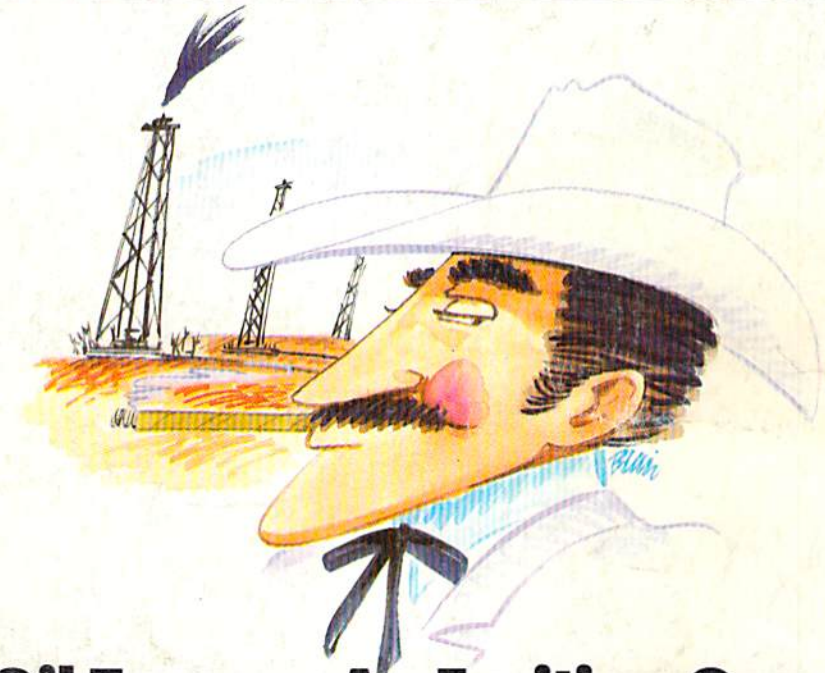
Speeding Up The VIC-20

A simple programming technique can speed up your games and other programs – without machine language.

Educational Games
Aardvark Attack & Word Match



In Aardvark Attack, mutant space creatures are threatening your cities with alphanumeric weapons.... Can you find the right letter-number combinations to defuse the bombs? Or, test your concentration skills with Word Match.



Oil Tycoon: An Exciting Game For VIC And Commodore 64

So, you think the big oil barons have it made? Wait until you play this strategy game and have to cope with the problems of exploration, limited drilling capacity, dynamite shortages, shrinking resources – even underground devils.

Also In This Issue

How To Use Files With Disk And Tape

Horizons: 64
By Charles Brannon

Best-Selling Software, Reviews, And More

Understanding Sound On The Commodore 64

The 64's sound is the best of any home computer, but it's hard to master. Part I of this new series explains how the built-in synthesizer works and includes programs so you can experiment yourself.

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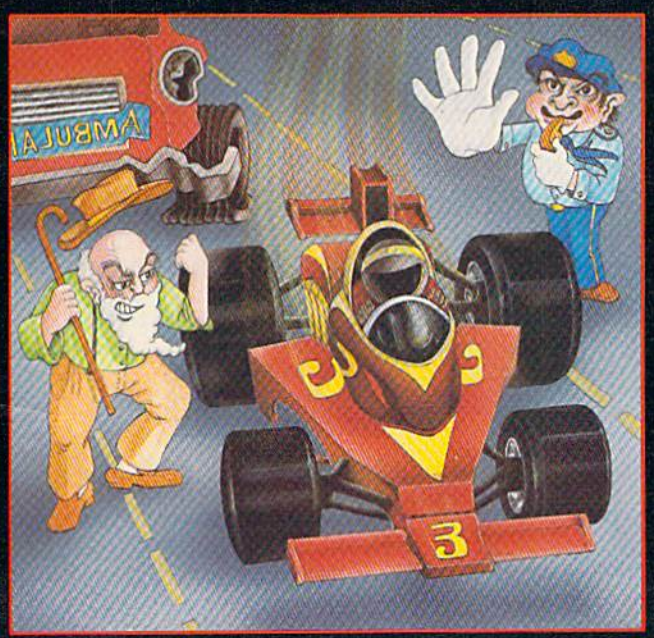

Feel like a devil today? Better adjust your halo. Start the ignition. It's up to you to decide... Okay, hit the accelerator. You can be the ultimate speed demon or put wings on your wheels! There's a pedestrian now...will you go for speed, no matter what pedestrians are in the way (for the devilish points)— or be an angel in a challenging obstacle course? The heavenly points may get you to heaven, but the devilish points may get you to...well, better make your decision— the time clock is running!

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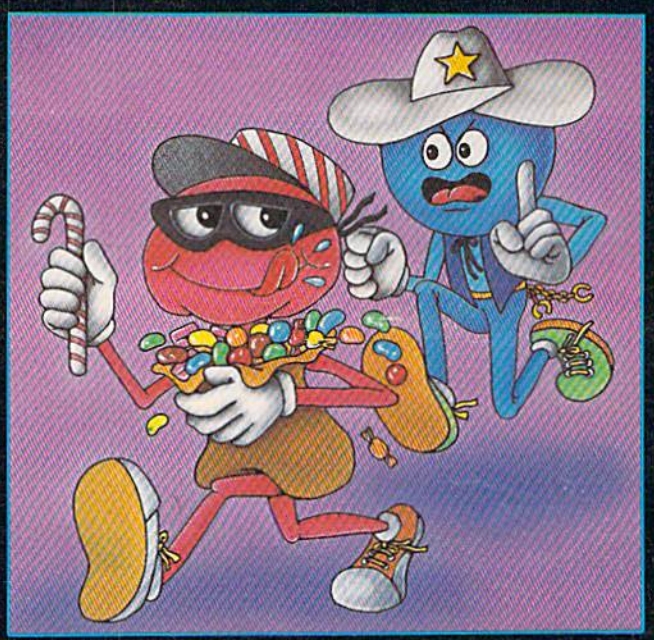

So your sweet tooth has gotten out of hand again? Well, this time the sheriff is after you and he's no sweetheart. There he is now! Quick! Grab all the candy in sight and dive for the doorway! Don't look now, the doors are rotating...better be good at getting out of sticky situations, 'cause if you hit the wall you're stuck with it! There's plenty of candy here and many more levels to cross, so get on the move, sugar!

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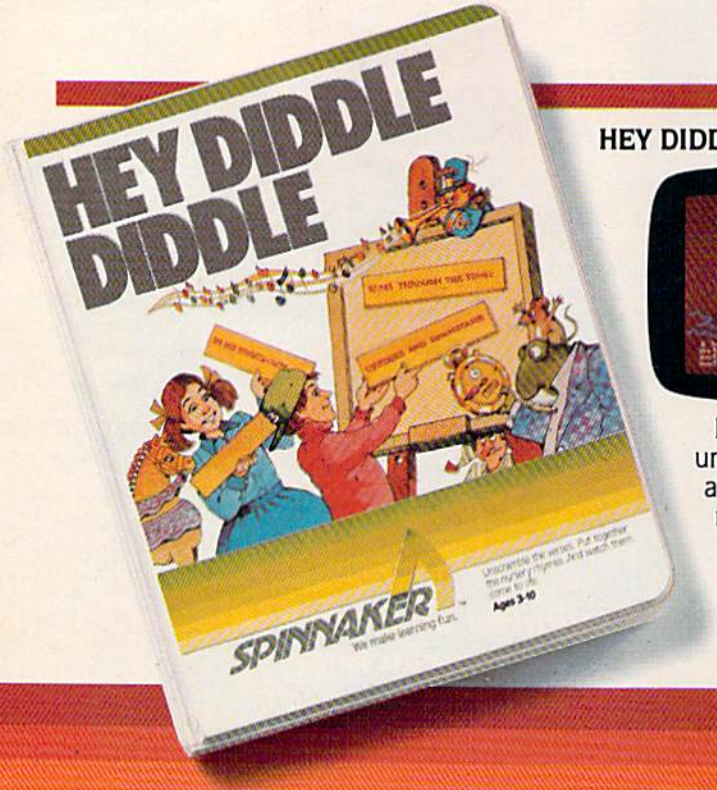

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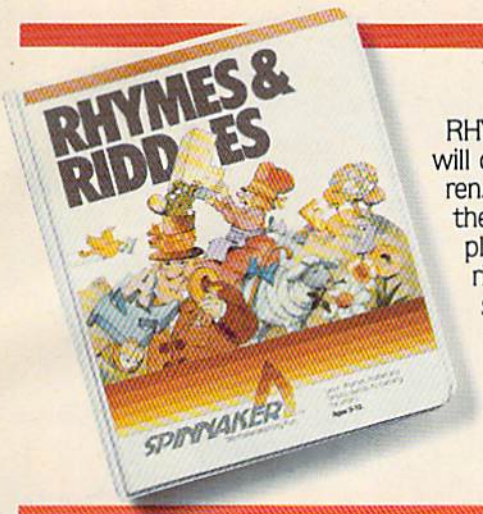

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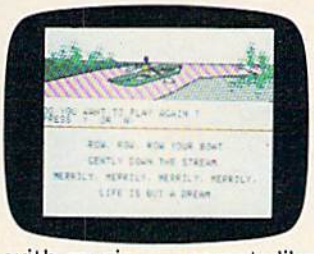

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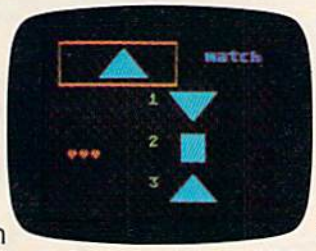
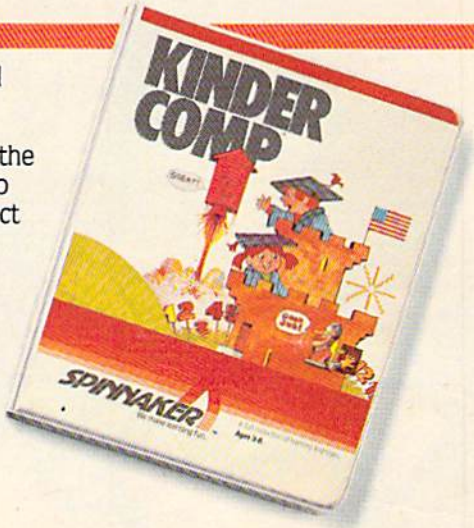


ful rewards, as the screen comes to life when correct answers are given.

As a parent, you can enjoy the fact that your children are having fun while improving their reading readiness and counting skills.



FACEMAKER™ makes faces fun. Ages 4 to 12.

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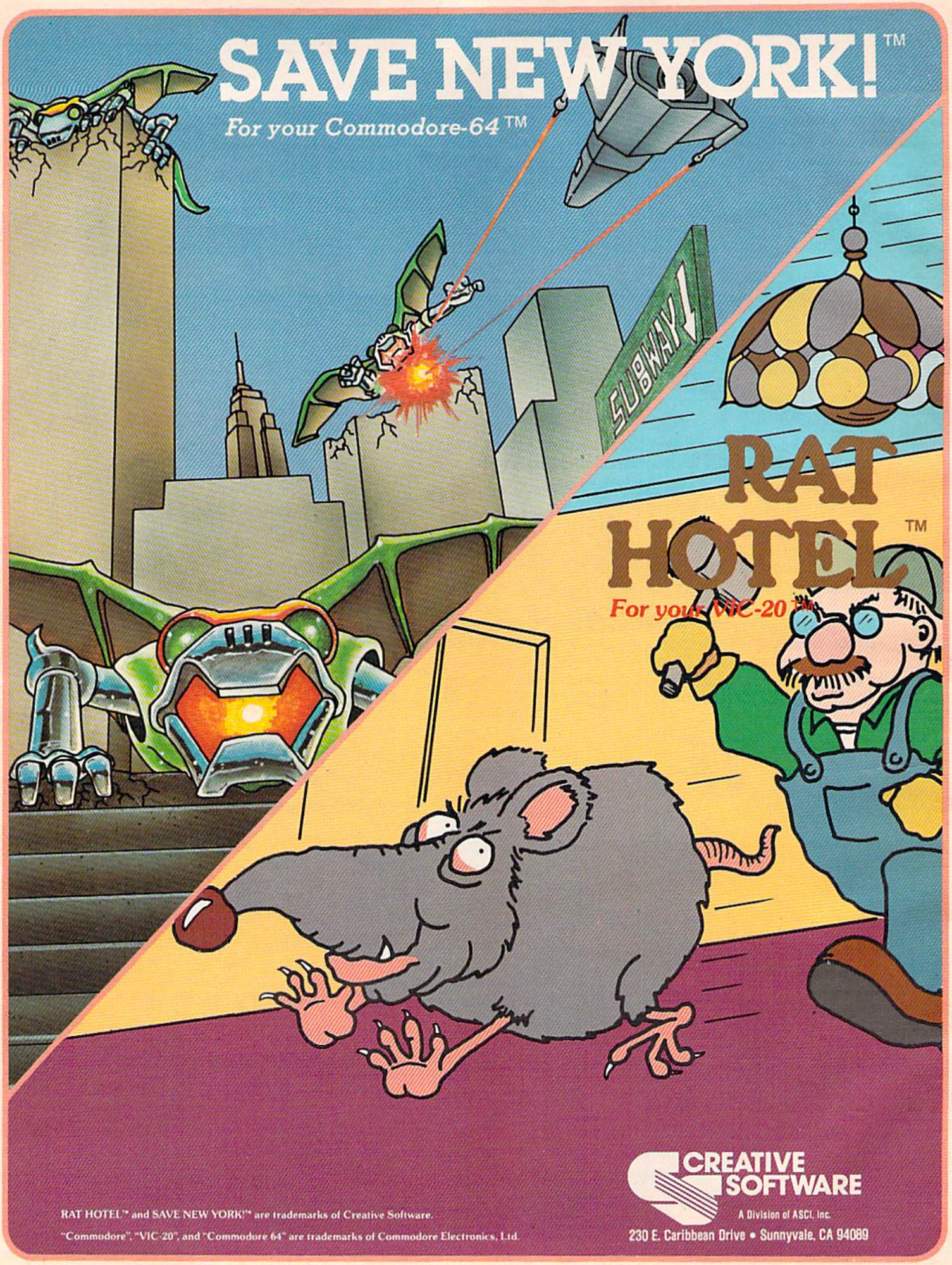

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FEATURES

The Anatomy Of Computers *Tom R. Halfhill* . . . . . 23 *
Telegaming Today And Tomorrow *John Blackford* . . . . . 32 *
The Automatic Proofreader: Banish Typos Forever! *Charles Brannon* . . . . . 48 *
Bargain Software For The 64: Commodore's Public Domain Programs *John Blackford* . 90 64

GAMES

Oil Tycoon *Gordon F. Wheat* 52 V/64
Re-Beep *Robert L. Lykins* 58 V/64
Inside View: Programmer Marc Blank *Kathy Yakal* . . . . . 64 *

REVIEWS

A Survey Of Inexpensive Word Processors For VIC And 64 *Larry L. Bihlmeyer & Kathy Yakal* . 94 V/64
WordPro 3 Plus/64 Dan Carmichael 101 64
Fast Eddie For VIC And 64 *Tony Roberts* 102 V/64

EDUCATION/HOME APPLICATIONS

Computing For Kids: From Dinosaurs To Freckles *Fred D'Ignazio* . . . . . 68 *
Aardvark Attack *Todd Heimarck* . . . . . 74 V
Word Match *Andy VanDuyne* 80 V/64
Computing For Grownups: Giants And Dwarfs *Fred D'Ignazio* . . . . . 84 *

PROGRAMMING

Hints & Tips: A SHIFTy Solution *Steven Darnold* 105 V/64
The Beginner's Corner: Program Transfer *C. Regena* 106 V/64
Machine Language For Beginners: Windows And Pages *Richard Mansfield* 112 V/64
Power BASIC: Improved Paddle Reader Routine *Dan Carmichael & Tom R. Halfhill* . . 117 V/64
How To Use Tape And Disk Files *Richard Mansfield* 118 V/64
Understanding Sound On The Commodore 64: Part I *Gregg Peele* 131 64
Speeding Up The VIC *Dan Carmichael* . . . . . 134 V

DEPARTMENTS

The Editor's Notes *Robert Lock* . . . . . 6 *
Gazette Feedback *Editors & Readers* . . . . . 10 *
Simple Answers To Common Questions *Tom R. Halfhill* . . . . . 18 *
HOTWARE: This Month's Best Sellers *Kathy Yakal* . . . . . 42 *
Horizons: 64 *Charles Brannon* 124 64
VICreations: Keeping Time With The VIC *Dan Carmichael* . . . . . 127 VIC
News & Products . . . . . 136 *

PROGRAM LISTINGS

Bug-Swatter: Modifications & Corrections . . . . . 142 *
A Beginner's Guide To Typing In Programs . . . . . 143 *
How To Type In COMPUTE!'s Gazette Programs . . . . . 144 *
Program Listings . . . . . 145 *

Product Mart 156
Advertisers Index 160

*=General, **V**=VIC-20, **64**=Commodore 64.

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THE EDITOR'S *notes*

The acceleration of Commodore personal computer sales continues. Our reading indicates that VIC-20 sales are not slowing down at all, and Commodore 64 sales are increasing. Best estimates are that by the end of 1983 we'll have an installed base of between 2,000,000 and 2,500,000 VICs and 64s. That is a lot of users. What does it mean for you existing owners? Well, first of all, you'll have to balance your feelings about the declining prices of the hardware with the realization that if you'd waited you wouldn't have been this far along in learning to use your computer. More importantly, for the future, it means you'll see more and better software and support materials at more reasonable prices. That should be the true benefit of this rapid expansion in the installed base. Increasing quality and declining prices... we'll keep our fingers crossed.

By the time you read this, our first two books for the Commodore 64 will be released, plus our second and third books for the VIC-20. Among the September/October titles being released by COMPUTE! Books are *First Book of VIC Games, Second Book of VIC, First Book of the Commodore 64, VIC Games For Kids, First Book of Commodore 64 Games* and *Creating Arcade Games on the VIC*. They're all of the same level of quality you've come to expect from COMPUTE! Publications, Inc. Check your local book or computer store for availability.

Automatic Proofreader, by Charles Brannon, appears in this issue. Those of you who have experienced problems with typing errors, etc., while entering programs will be quite pleased. This program literally checks *each* line of the program and lets you know if the line has been correctly entered. While the concept is not unique, the most useful part of the process is that it lets you know after each line is entered rather than waiting until all lines are entered. Thus, if a line is entered incorrectly, you can fix it immediately. Read Charles's article for full details.

Within the next few weeks, many of you will be receiving a reader survey (if you haven't already). Please take the few minutes necessary to fill out and return the questionnaire. It's invaluable to us in profiling you, our active readers.

Horizons: 64, our new column for 64 owners will now begin appearing each month. Horizons will be authored by Charles Brannon on a regular basis, replacing Larry Isaac's column, "64 Explorer." For you devoted fans of Larry's insight into the inner workings of the 64, don't despair, he's moved the column to COMPUTE! on a monthly basis. We felt that with this move, Larry could turn to the more technical side of the 64 where he excels.

Our growing editorial staff is in need of experienced writers. Our offices are located in Greensboro, NC, an excellent area to live and work. If you have a writing or journalistic background, and experience in the personal computer field, we'd like to see your résumé. Please send it along, in complete confidence, to:

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COMPUTE! has an excellent working environment, currently a staff of 80+, and as a division of American Broadcasting Companies (ABC) offers an excellent benefits package as well. We look forward to hearing from you.

Until next issue, enjoy your Gazette.

Robert Lock

Editor In Chief

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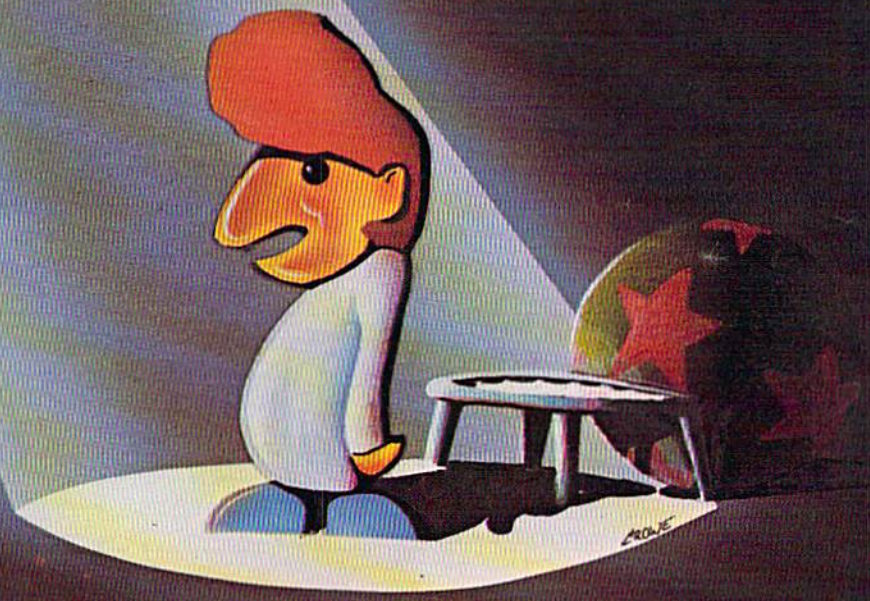

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GAZETTE FEEDBACK

EDITORS AND READERS

Do you have a question or a problem? Or have you discovered something that could help other VIC-20 and Commodore 64 users? Do you have a comment about something you've read in COMPUTE!'s Gazette *for Commodore? "Gazette Feedback" wants to hear from you.*

Pinning Down A Problem

I recently purchased a Commodore Video Monitor model 1701 to use with my Commodore 64 computer. The monitor came with a connecting cable that runs from the audio/video connector at the back of the computer to the audio/video terminals on the front of the monitor. The monitor user's manual mentions a three-jack cable that interfaces with the three terminals (audio, luma, chroma) on the back of the monitor. The interface is supposed to provide better screen resolution than the front connections.

The manual mentions that the computer must have an eight-pin audio/video connector to do this, and my computer has a five-pin arrangement. My question: Is there a cable available that will permit connecting a five-pin 64 to the monitor's three rear terminals, thereby improving the monitor's resolution? I have heard that such a device exists, but I have not seen it advertised anywhere. Can you provide any information on this subject?

Bruce D. Perine

We're glad you asked this question, because the answer is one of the best hints we've run across in some time. The following was conveyed to us by Associate Editor Jim Butterfield. Yes, you can connect your five-pin 64 to the Commodore 1701 color monitor while greatly *improving the picture quality. And it can be done without an external interface. But first, a brief explanation of the 1701 monitor and what the various connections are for.*

The two inputs on the front of the monitor (VIDEO and AUDIO) are easily connected to the Commodore 64 with the cables Commodore includes with the purchase of the monitor. The problem with these connections is that they do not allow you to get the best picture available from your 64. Without being too technical, this is because the VIDEO plug mixes two signals together, the chrominance and luminance. Briefly, the chrominance is the "color" in the color signal, and the "luminance" is the brightness. When these signals are mixed together, it causes a slight degradation of both which produces a less than optimal picture.

However, the 1701 color monitor has three connections in the rear: CHROMINANCE, LUMINANCE, and AUDIO. This allows you to perform the hookup without mixing signals. The hookup can be made without an interface, but you will have to buy a new cable, or make one yourself.

Here's how to hook it up. First, turn off and unplug the computer and monitor. Second, flip the switch on the back of your monitor labeled "Signal Select" to the "Rear" position. When this switch is set for "Rear Select," the connectors on the front of the monitor are disabled and vice versa.

Now purchase an all-purpose "octopus" type computer hookup cable at your local computer or electronics dealer. This cable should have the standard five-pin DIN plug (see your Commodore 64 User's Manual*) on one end, and four RCA-type plugs at the other. Connect three of the plugs to the CHROMA, LUMA, and AUDIO connectors at the rear of the monitor. The fourth is left unconnected. Although your cable color coding may be different, the ones we have here at COMPUTE!'s Gazette hook up as follows: white to CHROMA, red to LUMA, and black to AUDIO. If the connector colors on your cable are different, you can experiment with different hookup patterns until the best picture/audio combination is achieved. Switching plugs around shouldn't be harmful to the computer or monitor, but don't touch the center pin of any connector to any ground source or to any metal surface.*

If you cannot find a general-purpose connecting cable at your local store, you can make one yourself or have your local Commodore dealer do it for you. Check the Commodore 64 Programmer's Reference Guide *for complete details. Briefly, you need to wire three RCA-type plugs to the DIN connector at pins 1 (luminance), 3 (audio output), and 4 (video out). Pin 2 is your ground. The plug from pin 1 will connect to LUMA on the monitor, pin 3 to AUDIO, and pin 4 to CHROMA. No interface is required between the 64 and the 1701 monitor. After you have successfully completed all the connections, readjust the settings on your monitor for the best picture.*

It can be well worth the time and cost to perform these new connections. Buying the pre-wired all-purpose

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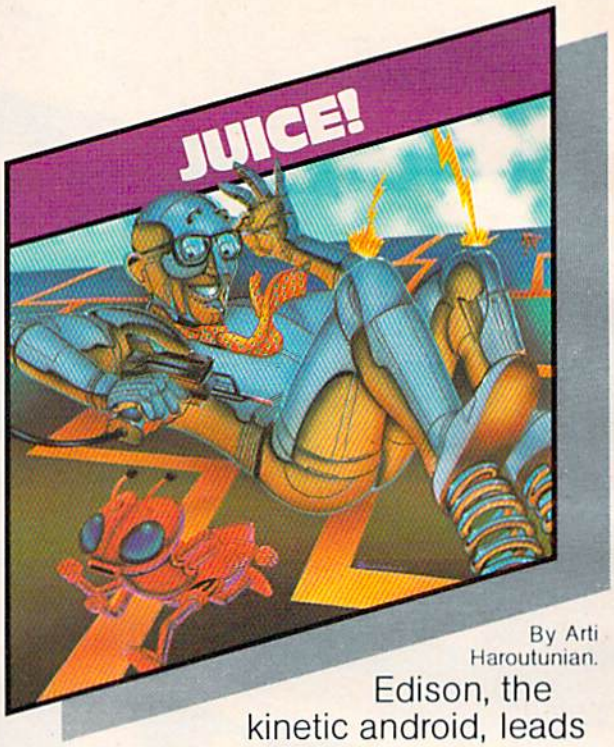

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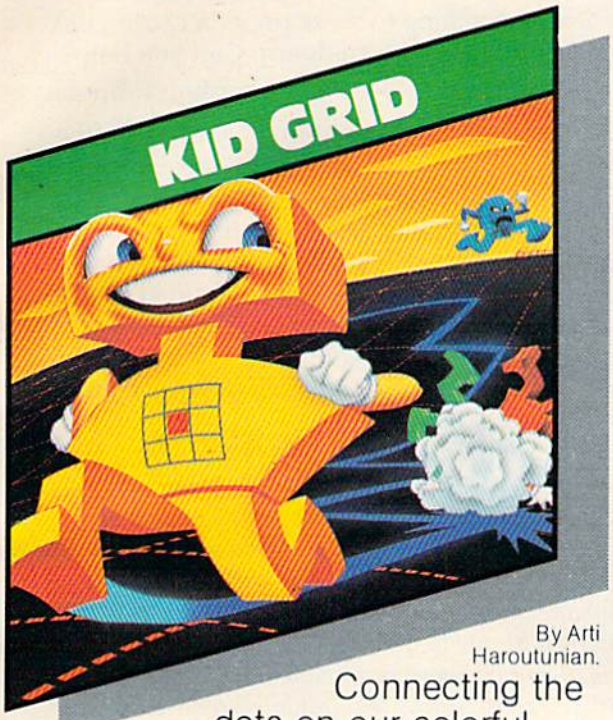

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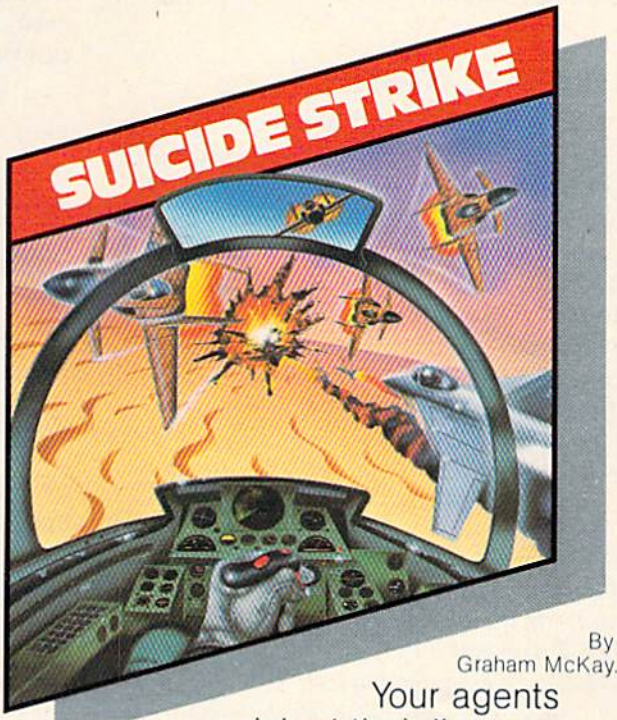

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cable or constructing it yourself should cost you no more than $10, and believe us, it's well worth it. The improvements in picture sharpness, clarity, and color are magnificent. For more information on Commodore 64 video, see the new column "Horizons: 64" premiering this month.

Partial Screen Clears

I have a new Commodore 64. I have used a Radio Shack TRS-80 Model III for three years. I have three programs which use the split screen, containing calculated data at the top which is updated by questions on the bottom of the screen. Is there any way to change the HOME/CLR address on the Commodore 64 so that the lower part of the screen can be cleared without changing the upper section? Tandy MicroSoft BASIC allows CHR$(30) to clear to end of line and CHR$(31) to clear to end of screen. It also allows up to seven lines to be reserved from the CLS (clear screen) operation.

John R. Land

Commodore 2.0 BASIC (as found in the VIC-20 and 64) does not support partial clearing of the screen. However, you can write this option into your program with one FOR/NEXT loop and a POKE. The way to do this is to POKE blanks (screen display code 32) to the area of screen memory you want to clear. If, for instance, you would like to clear only the bottom half of your screen, include this line in your program:

```
60000 FOR A=1544 TO 2047: POKE A,32: NEXT A
```

Following is a short, simple machine language routine that you can add to your programs. When you want to clear the bottom three-quarters of your screen, include SYS49152 in your program; to clear the last half, SYS49162; and to clear only the last quarter, SYS49172. The machine language routine will LOAD into memory at 49152 and will not interfere with your BASIC program.

```
60000 FORA=49152TO49183:READB:POKEA,B:NEX
    T                                  :rem 53
60010 DATA 162,0,169,32,157, 24, 5, 232
                                       :rem 226
60020 DATA 208,250,162,0,169,32,157, 8
                                       :rem 26
60030 DATA 6,232,208,250,162,0, 169, 32
                                       :rem 19
60040 DATA 157,248,6,232,208,250, 96, 0
                                       :rem 32
```

DOS Woes

When I first bought my VIC-20, I was very impressed with it, and I still am. But the more I work with the Disk Operating System (DOS), the less impressed I am. I have had some problems with the system, and I would appreciate your help.

When I use the "save and replace" (SAVE "@0:filename") as outlined on page 13 of the *1541 User's Manual*, more than three times it has started replacing the programs saved immediately before it without changing the names in the directory. So eventually I have the same program under several different names, and I lose the original programs. I think this is a ROM problem. Because I purchased the disk drive by mail order, no local authorized service center is willing to work on it (because I did not purchase the drive from them). Can you help?

Stephen Johnson

First, don't have your drive repaired. The cause for the errors while using the "save and replace" command is in Commodore's DOS, not your drive.

Some of Commodore's disk drives through the years have had some problems with this option. The first drives to exhibit this problem were the dual 2040's. Although the updated DOS found in the VIC-1540 and 1541 disk drives was supposed to correct this problem, it has not. Problems with the save and replace command still occur now and then.

The best solution is simply to stay away from this command. Instead, save your programs with "generation" identifiers. For instance, use names such as "program.g1" or "program.g2". When you look at your directory, you will be able to tell which is the most recent update by the generation numbers. Erase earlier generations with the SCRATCH command.

It may be a bit more inconvenient this way to keep your disks clean of unwanted, outdated revisions, but it's a lot better than losing that favorite program of yours altogether.

WordPro Colors

I have recently purchased a word processor (*WordPro 3 Plus/64*) for my Commodore 64. I find that the software automatically chooses white text on light blue background rather than light blue text on a dark blue background as programmed by the manufacturer. Is there any way of choosing light blue text rather than white? The resolution on my set seems to work better with light blue text on a dark blue background.

Also, is it possible to make a backup disk of this program, or is it made not to be copied?

Robert A. Konkol

Yes, it is possible to change the color combinations while working with WordPro, *and the color change options are part of the* WordPro *program. Instructions can be found on pages 2-17 of your* WordPro 3 Plus/64 User's Manual. *Briefly, it's done with the special function keys (F-keys). Press CTRL, then f-1, to change the text colors, press CTRL - F-3 to change the screen colors, and press CTRL - F-5 to change the border colors. (For more information on the* WordPro 3 Plus/64 *word processor, see the review in this issue.)*

As to your second question, WordPro *cannot be copied. This program, as well as the majority of other commercial programs available on disk, is engineered to be copy-proof. This is how companies protect their copyrights.*

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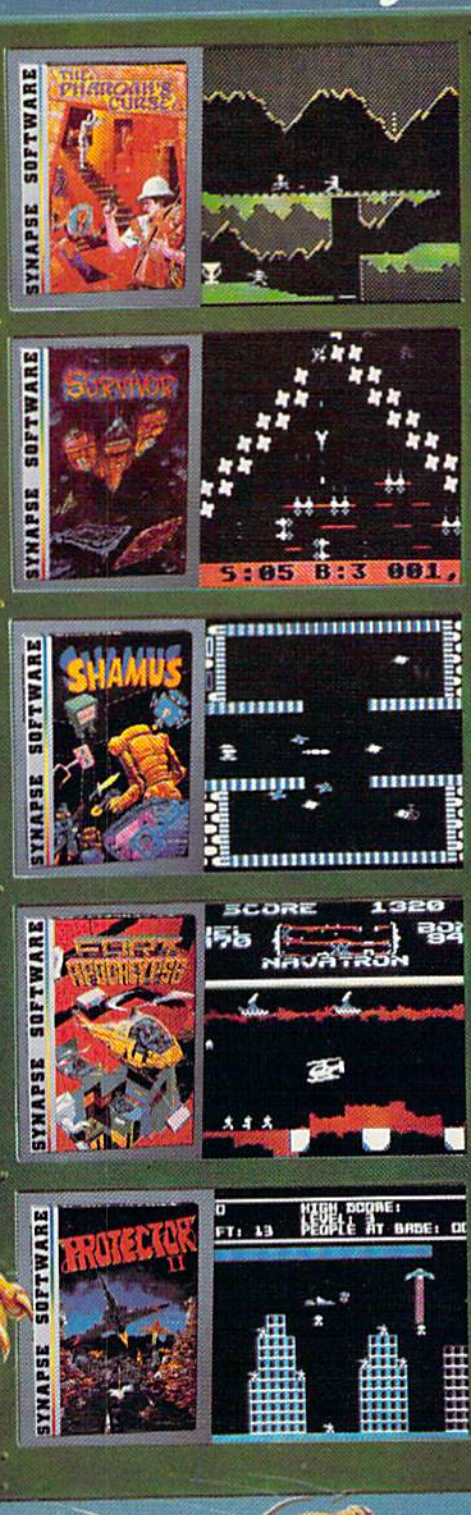

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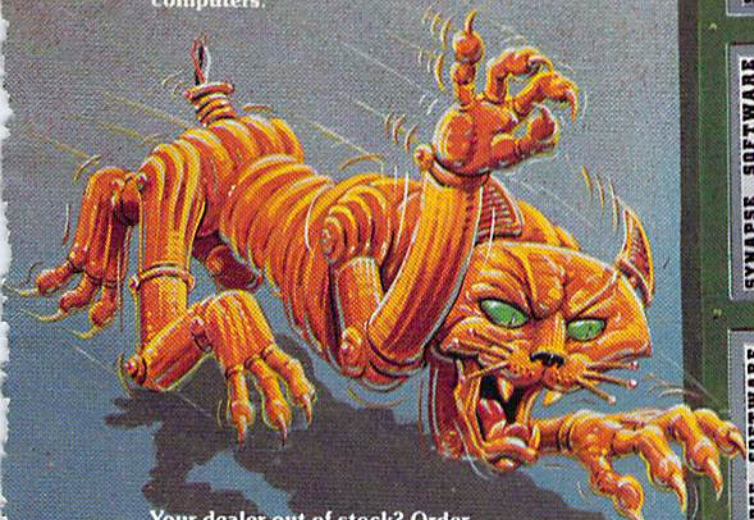

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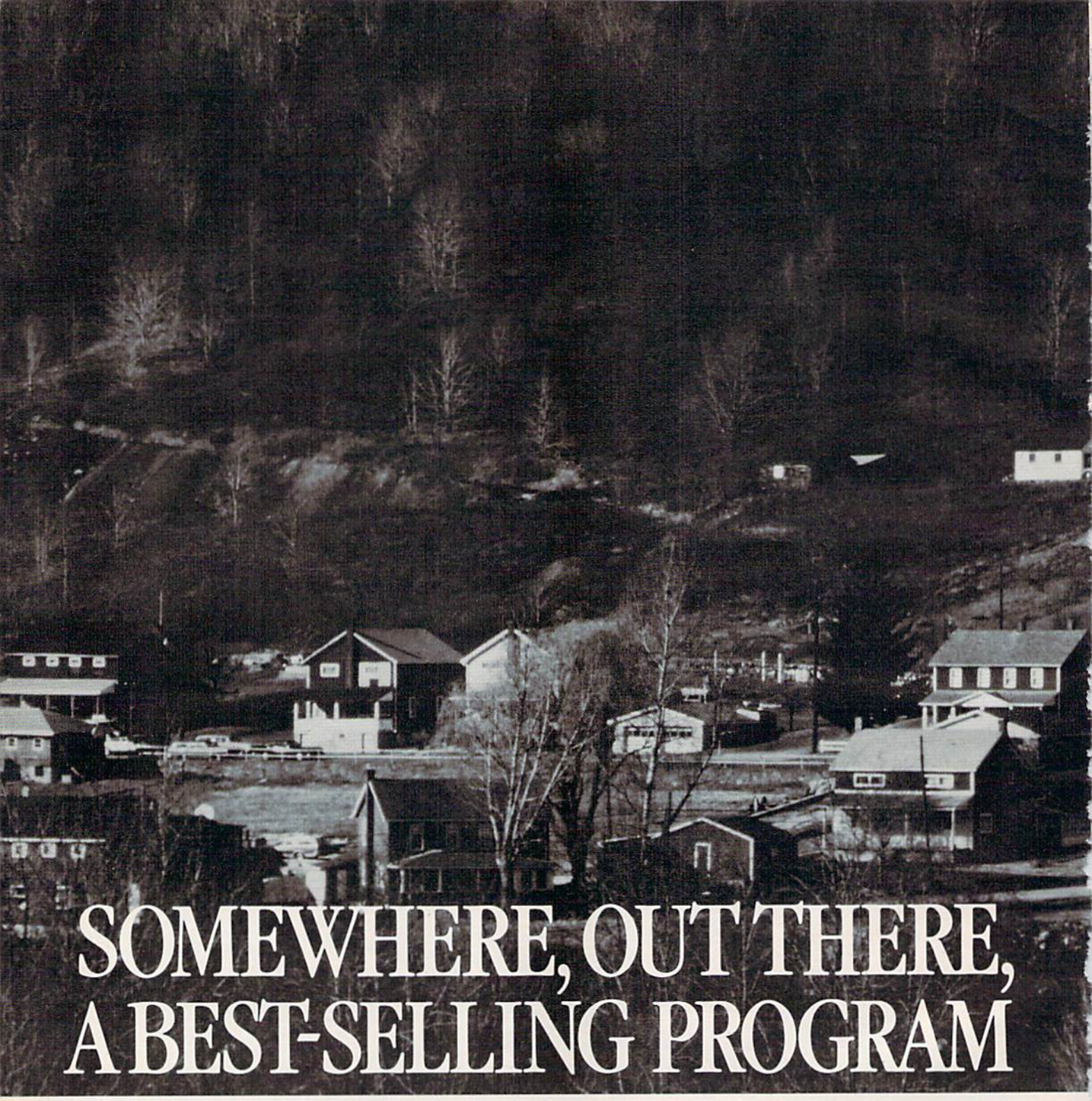

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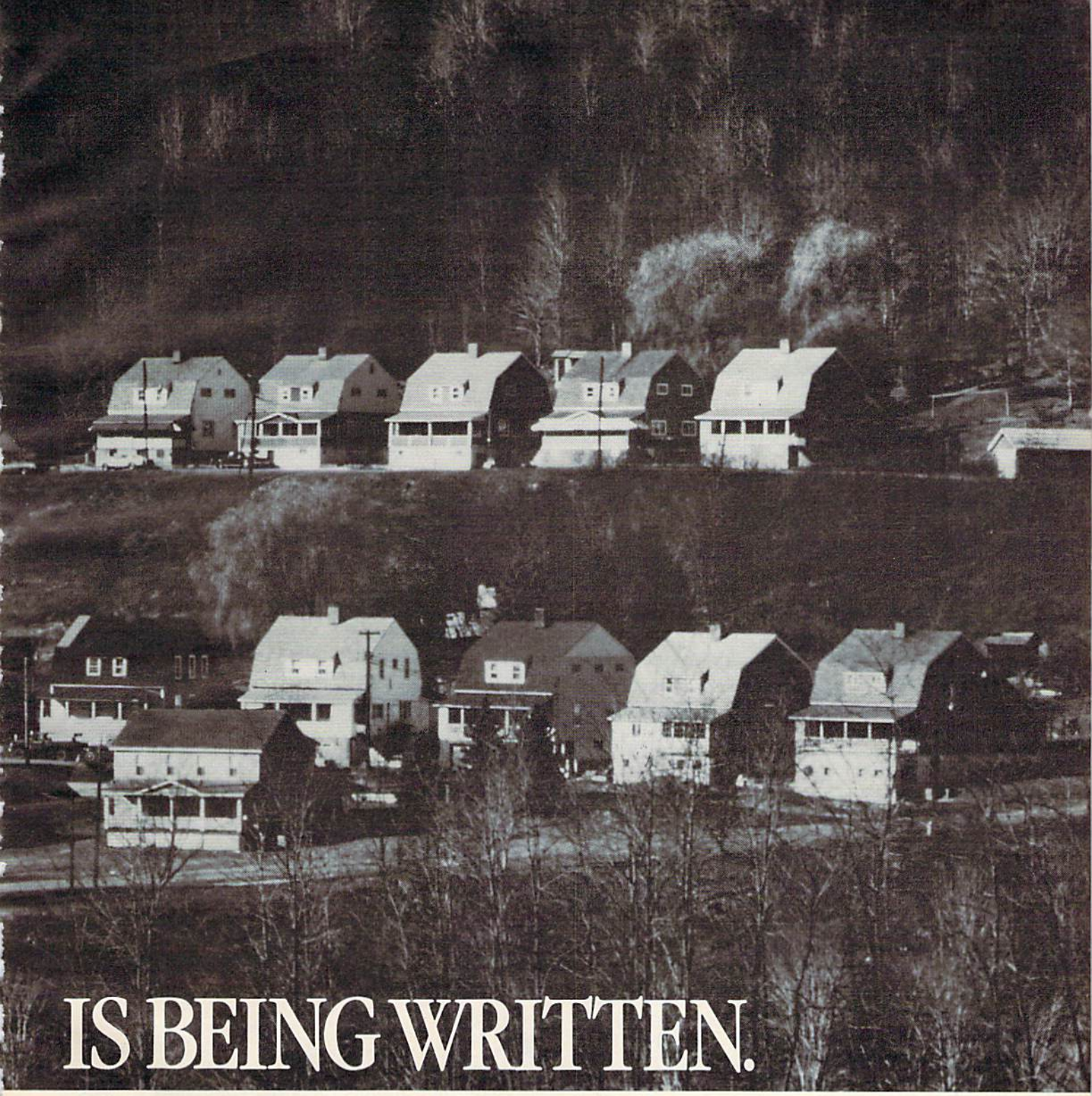

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SIMPLE ANSWERS TO COMMON QUESTIONS

TOM R. HALFHILL, EDITOR

Q A

Each month, COMPUTE!'s Gazette for Commodore will tackle some questions commonly asked by new VIC-20/ Commodore 64 users and by people shopping for their first home computer.

Q. ***Some of the programs published in COMPUTE!'s Gazette and other magazines are in separate parts. I mean, you have to save the programs one after the other on tape and then load them separately. The first part will load and show a screen message telling you to "PRESS PLAY ON TAPE" and then load the second part. But what happens if you have a disk drive? Can you use these programs on disk?***

A. Yes, you certainly can use these *multistage* programs on disk as well as tape. In most cases, you won't even need to modify the programs. Try this:

First, type in the programs and SAVE them on the same disk with filenames that clearly indicate the order in which they should be loaded. For instance, "SPACE GAME 1" and "SPACE GAME 2". Then LOAD and RUN the first stage of the program as instructed in the article. When you see a screen message that says something like "PRESS PLAY ON TAPE," press the RUN/STOP key instead (*do not* press RUN/STOP-RESTORE). You should see a BREAK message and the READY prompt.

Now, LOAD and RUN the next stage of the program. If there is a third stage, repeat the process. In almost all cases, this should do the trick.

If you know something about BASIC programming, you can modify the programs so they automatically load the following stages from disk. Locate the lines which tell the computer to load the next stage from tape (usually found near the end of the program). Delete these lines and add a statement such as:

```
LOAD"SPACE GAME 2",8
```

Of course, this statement must be preceded by a line number, and you'll want to substitute your own filename for the example given. Also, make sure a disk with the subsequent stages is in the disk drive, or you'll get a FILE NOT FOUND error.

Multistage programs may seem inconvenient to use, especially with tape, but there's a good reason why programmers resort to this technique. By separating a long program into stages, it's possible to make it run on computers with limited memory, such as the unexpanded VIC. Commodore 64 users would almost never encounter a multistage program. But it's hard to write a complex game or other type of involved program to fit the VIC-20's 3.5K of available Random Access Memory (RAM). Such frills as screen instructions, which are viewed only once, do not need to occupy valuable memory while the main program is running. By dividing instructions and other setup functions into stages which are loaded first and then replaced, memory is conserved for more important tasks.

Q. ***Is there any way to salvage a cassette that gets jammed?***

A. There's at least a chance. Radio Shack stores sell "cassette repair kits" that include an empty cassette shell and instructions. You'll have to take apart the jammed cassette, transfer the tape to the new shell, and assemble the new cassette with the screws provided. If the tape itself was not severely twisted or creased, everything may be okay.

If the program still refuses to load properly, the tape was probably damaged. To fix it, locate the length of creased tape. Try to flatten out the crease so it will make good contact with the recorder's read/write head. If this doesn't work, the tape is probably ruined.

If a jammed cassette causes the tape to actually

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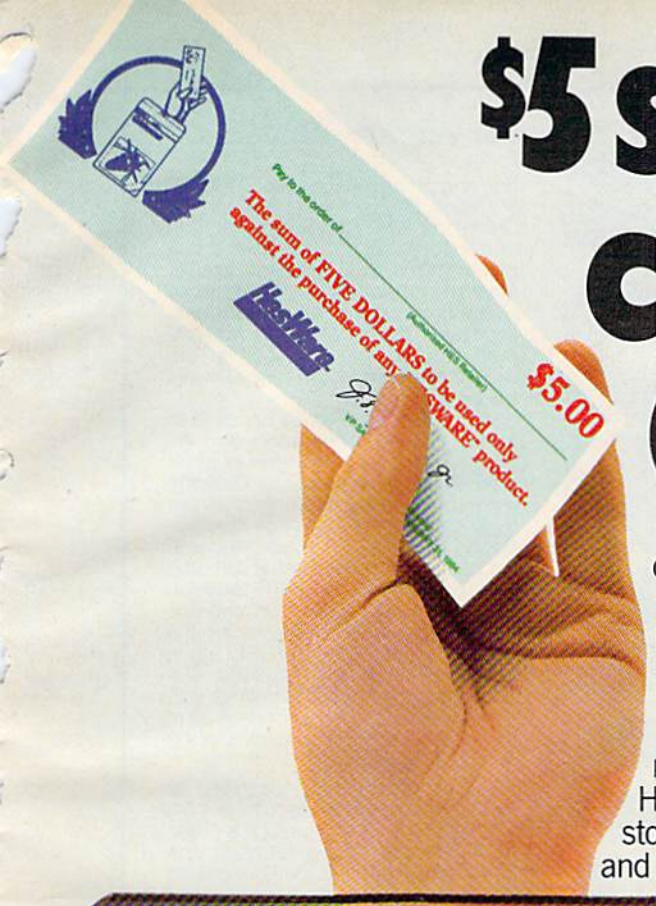

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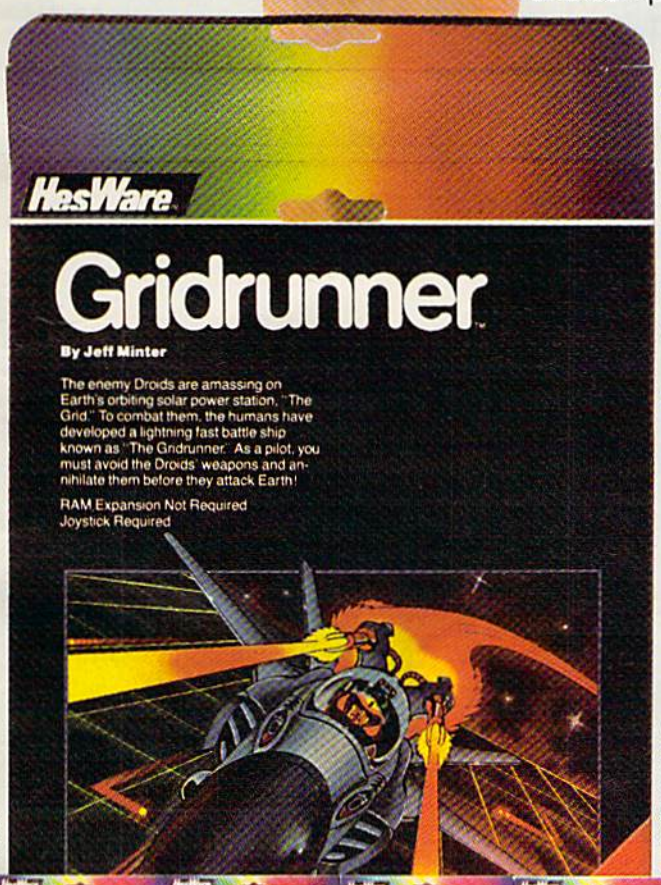

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break, we're sorry to say the situation isn't too hopeful. Although tape can be spliced, an "inaudible" splice for audio purposes will almost never be good enough for the computer; the data is recorded too densely. It's worth a try, though, especially if the tape holds the only copy of an important program. Before discarding a tape that has snapped, check to make sure that the leader hasn't simply been pulled off the hub – this can nearly always be fixed.

These kinds of problems are good reasons for backing up all important programs and data. You should have at least two copies, *on separate cassettes or disks*, of everything you can't afford to lose. To be even safer, you should store the backups in a different place than the originals.

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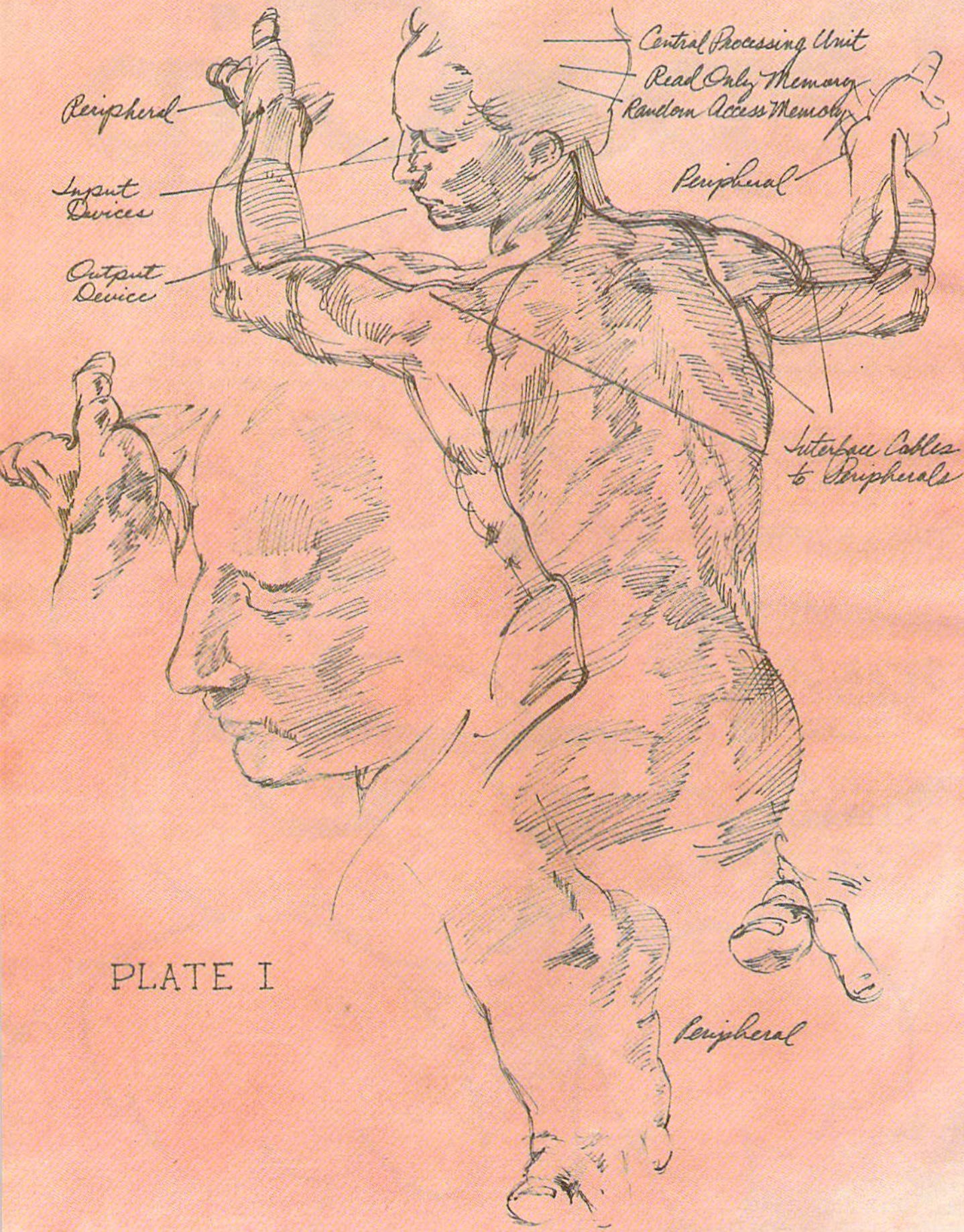
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PLATE I

The Anatomy Of Computers

Tom R. Halfhill, Editor

Computers are easier to understand when you know what makes them tick. Here's how the parts of a computer work together – often invisibly – to create the results you see on the screen.

You don't have to be a mechanic or automotive engineer to drive a car. And you certainly don't have to be an electrical engineer or programmer to use a personal computer.

But a little knowledge about what's going on beneath the hood of your VIC-20 or Commodore 64 can go a long way when you're trying to fathom how a certain program works – or why it doesn't work. A cryptic error message such as "?DEVICE NOT PRESENT ERROR" makes a lot more sense when you understand how a computer interacts with its various devices. And even if you aren't interested in programming, a basic understanding of computers can make it clear why you have to type certain commands at certain times, or do other things just because the manual says so.

In many ways, computers are remarkably similar to the human brain, at least in terms of organization. Like the brain – which we call an "organ," although it is really several closely related structures – a computer is a system of interconnected subsystems.

Unlike the brain, however, which can perform many operations at once, most computers can do only one thing at a time. This might seem hard to believe, especially if you've ever played a fast-action computer game in which dozens of objects seem to be darting around the screen simultaneously. But it's true. Computers only *seem* to perform many operations at once because they work so quickly. Even the slowest home computer can easily carry out hundreds of thousands of instructions per second. Simultaneity is an illusion.

The main "brain" of a computer is the *Central Processing Unit*, commonly abbreviated CPU. The CPU performs or supervises all the major functions of a computer. One by one, it fetches the instructions written by human programmers, works the math, stores the results, and looks for the next instruction.

CPU size once determined computer size. Even today, the CPU of very large computers might occupy a box the size of a refrigerator. In early computers, those built in the 1950s and 1960s, the CPU sometimes occupied a whole room, or even a building. The breakthrough which made possible today's personal computers came in 1971, when engineers managed to squeeze an entire CPU onto a single "chip" of silicon smaller than a

fingernail. From this *microprocessor* was born the *microcomputer*. Generally speaking, a microcomputer is defined as a computer which uses a microprocessor CPU, is small enough to fit on a tabletop, and costs less than about $20,000.

There are many types of microprocessors. The VIC-20's CPU is a microprocessor designated the 6502. It was designed in the early 1970s by MOS Technology, now a subsidiary of Commodore. The 6502 is an extremely popular chip because of its high speed and low cost (under $5 in quantity). The Commodore PET, SuperPET, and 8032 models, as well as Apple and Atari computers, all use the 6502. The Commodore 64 uses a newer version of the 6502 called the 6510, identical in all important respects to its predecessor.

But a CPU alone does not make a computer. By itself, a CPU is like a disembodied brain – a small package of functionless "intelligence." The CPU must be connected to a few other subsystems before it can qualify as a computer.

The next most important part is memory. The CPU already includes a very small amount of memory, but not enough to make it useful. So, the CPU is wired to a set of memory chips.

Memory followed the same evolution as CPUs – starting out as roomfuls of bulky vacuum tubes, then passing through the stages of transistors, integrated circuits, and finally silicon chips. In personal computers, there are two general types of memory chips: *Random Access Memory* (RAM), and *Read Only Memory* (ROM). There's a vital difference to remember between RAM and ROM – *RAM needs a constant flow of electricity to maintain its memory*, while *ROM holds its information even when the power is turned off*.

Whenever your computer is switched off or "powered down," even for a split second, all the information held in RAM is instantly erased. Turning the power on again does not restore it. What's more, RAM happens to be where your programs are run. That's why, every time you switch on the computer, you must load in the program you want to use from a cassette tape or floppy disk, or else plug in a cartridge. The program, a series of instructions for the CPU, is permanently stored on the tape, disk, or cartridge. Typing the LOAD command copies the program from the tape or disk into RAM.

ROM, however, is quite different. Information is permanently "burned" into ROM chips by the manufacturer. You cannot change or erase the information in ROM. ROM chips are used inside computers to store information which the computer always needs and must never forget. ROM chips also are found inside plug-in program cartridges. Some manufacturers prefer to store frequently used programs – such as games – on cartridges instead of on tapes or disks, which are more easily damaged or worn out. Cartridges are also more convenient. When you plug in a cartridge, its ROM chips (and the information they hold) become part of the computer, so there is no waiting for a tape or disk to load.

The amount of memory in a computer depends on the number and type of memory chips it has. When people compare memory between computers, almost always they are referring to RAM. Computers with more RAM can hold larger programs and more information, which generally makes them more powerful.

For easy comparisons, memory is measured in *kilobytes*, abbreviated K. A kilobyte is 1024 *bytes*. A byte consists of eight *bits*, or binary digits. If you're unfamiliar with the binary number system, it's best to think of a byte as one character – a letter, a number, or a symbol. A kilobyte of memory can hold roughly a thousand characters.

Comparing kilobytes of RAM is one way of estimating the relative power of various computers – *but not the only way*. The VIC-20 comes with 5K of RAM, expandable to 32K, and the Commodore 64 has 64K of RAM. Does this mean a Commodore 64 is more than 12 times as powerful as an unexpanded VIC? It's not that simple. When comparing computers, remember that many other features besides memory must be taken into consideration, and that some features may be more important to some people than to others.

Equipped with a CPU and memory, a computer is roughly equivalent to a human brain. But to make a computer (or a brain) really useful, several more parts are required.

As a body has appendages, a computer has *peripherals*. These are devices attached to the CPU which enable it to communicate with the outside world, and especially with humans. Peripherals come in two types: *input* devices and *output* devices (some do both).

You may be so familiar with some of these devices that you might not even think of them as peripherals. For instance, the keyboard. The CPU constantly scans this input device and checks if any keys are pressed. When you press a key, a keycode number is stored in a certain place in memory. The CPU reads this memory location and acts accordingly. Among the things it might do is display the character you typed on one of its output devices, the TV screen. The keyboard and the screen are the most basic input and output devices of the computer.

One of the most important keys is RETURN. It derives its name from the carriage return key or lever on typewriters, and it returns the cursor

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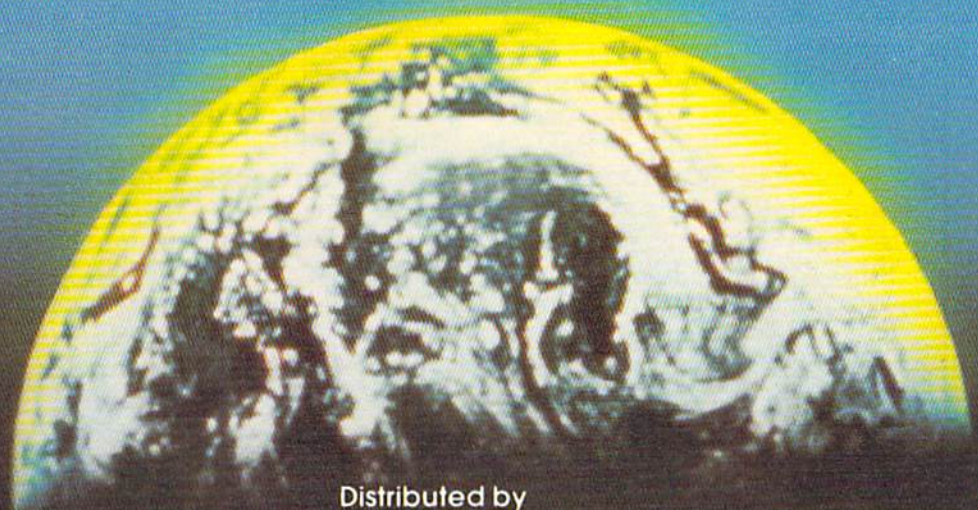

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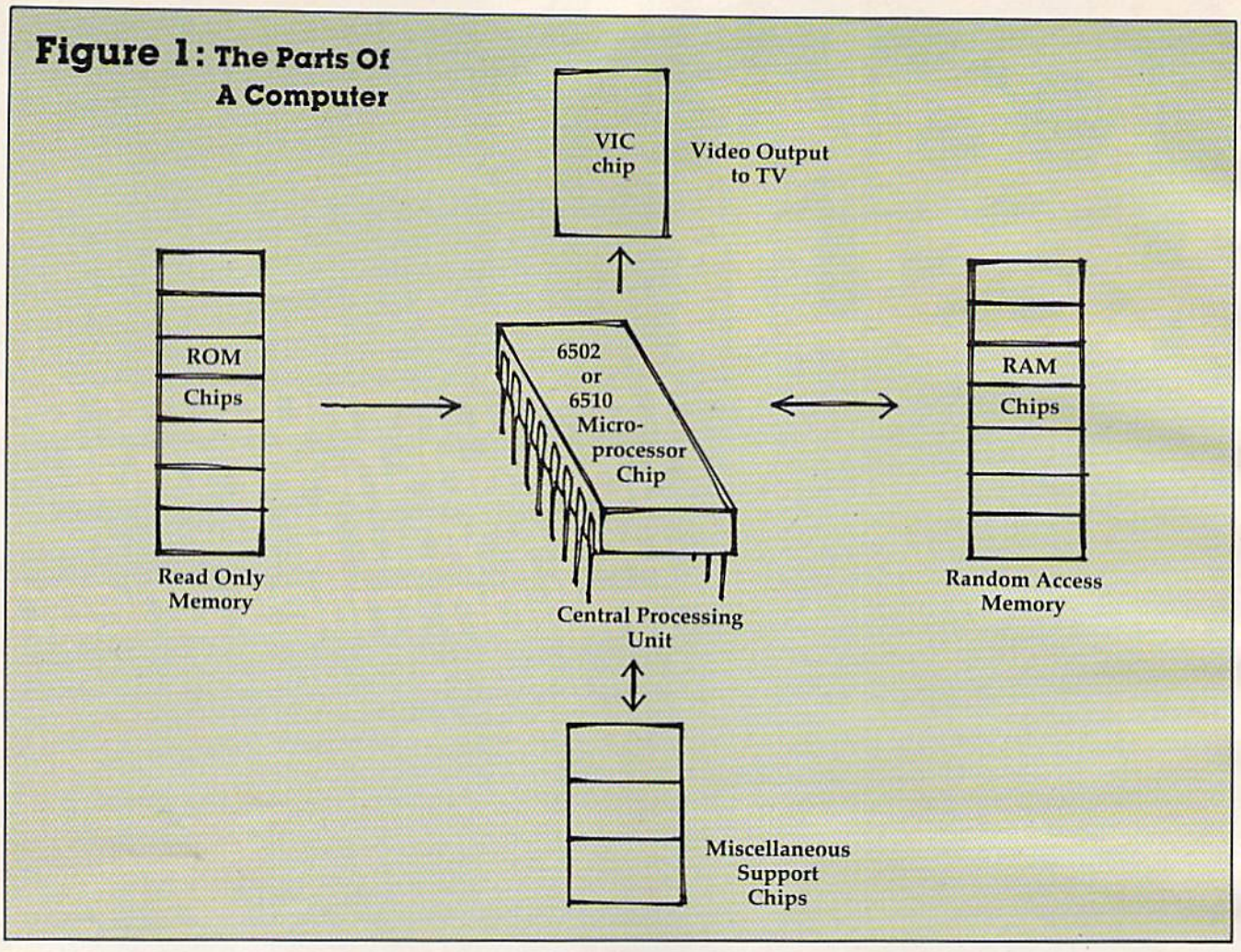
Figure 1: The Parts Of A Computer



(the moving white block) to the left screen margin when pressed. But it has an added function not found on typewriters – it tells the CPU to interpret whatever was just typed as a command.

For example, type the command LOAD, without pressing RETURN. The word appears on the screen, but the computer just sits there. The CPU knows you typed the letters L-O-A-D – after all, it read them from the keyboard and displayed them on the screen – but the letters are meaningless. The CPU ignores them.

Now press RETURN. Immediately, the computer displays the message, "PRESS PLAY ON TAPE."

By pressing RETURN, you told the CPU to accept the letters on that screen line as a command – specifically, a command to load a program from the cassette recorder. The CPU checked the recorder – similar to the way it checks the keyboard – and discovered the PLAY button was not depressed. Then it displayed the appropriate prompt. Until you press RETURN, the computer ignores what you type, allowing you to correct typing errors or change your mind.

The cassette recorder, of course, is another familiar peripheral – an input/output device. When loading a program from tape, it acts as an input device (remember that input/output is always from the *computer's* point of view). When you save a program on tape, the recorder becomes an output device.

You may have other peripherals in your computer system. A printer is an output device. A joystick or game paddle is input. A disk drive is both input/output. So is a modem. It's easy to see that without peripherals, the most powerful CPU and memory would be utterly helpless – the computer would be blind, deaf, and mute.

So far, we've confined this discussion to hardware, the parts of a computer that we can actually see and touch. But the hardware is just a collection of silicon chips, circuit boards, wires, metal, and plastic. It's like a human brain and body without life; it needs something more to make it work. What it needs is *software*.

Software is the programming which tells the CPU what to do and how to do it. Software is to hardware what the human mind is to the brain. If the software is poor, the computer may appear stupid, but the problem is really unexploited

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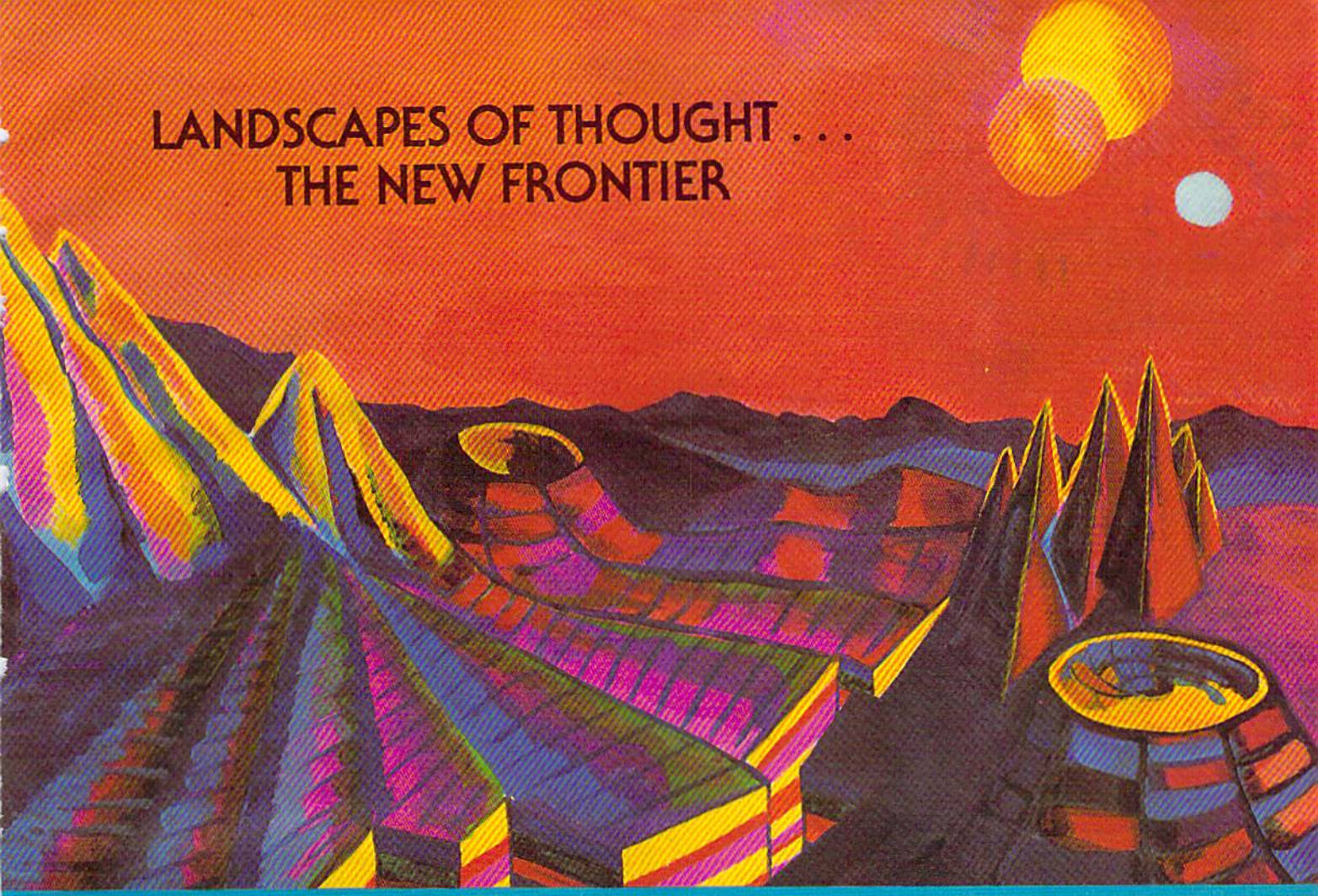

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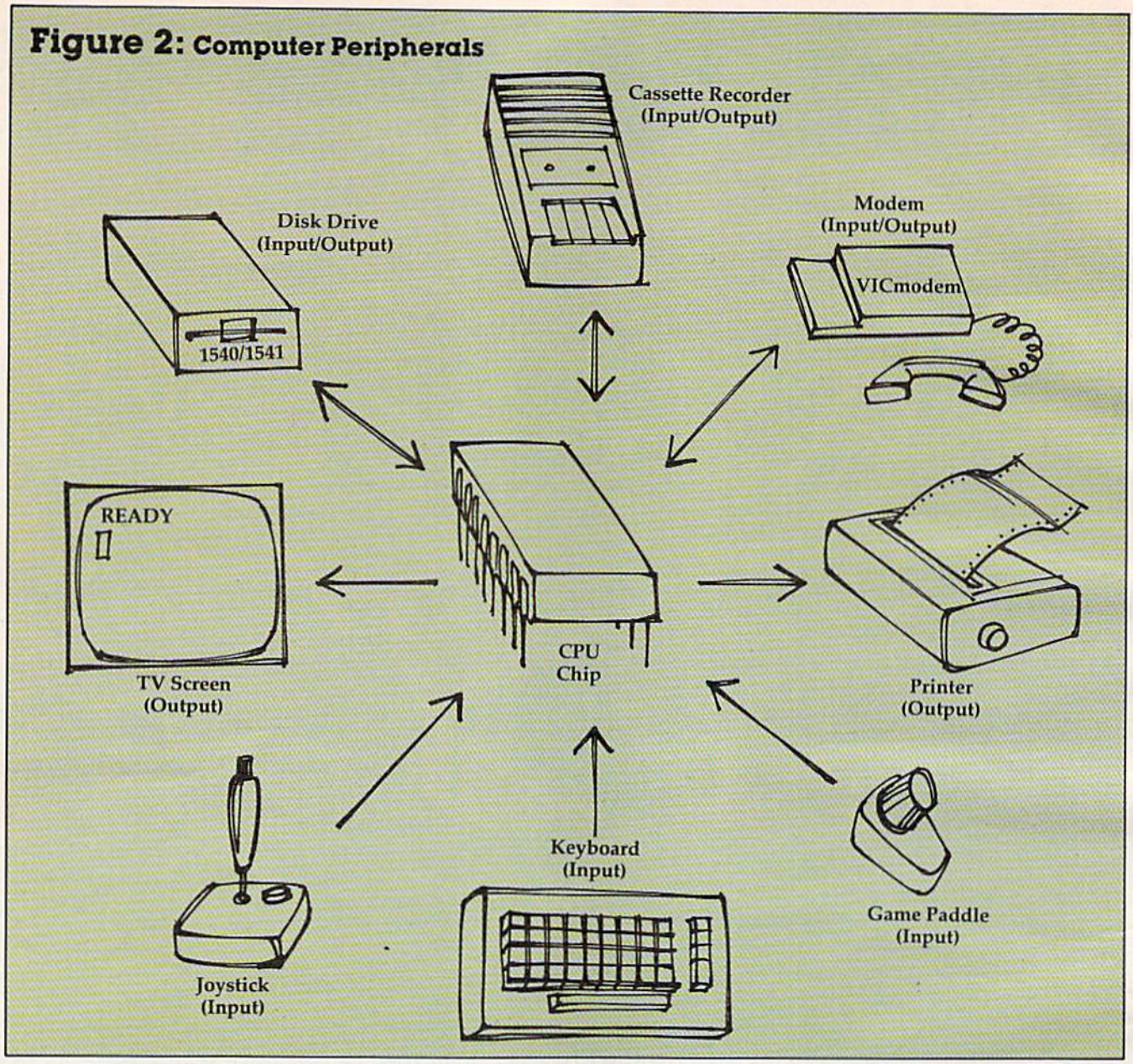
Figure 2: Computer Peripherals



potential. It's like an intelligent human with no knowledge. No matter how good a computer is, it won't appear much better than its best software.

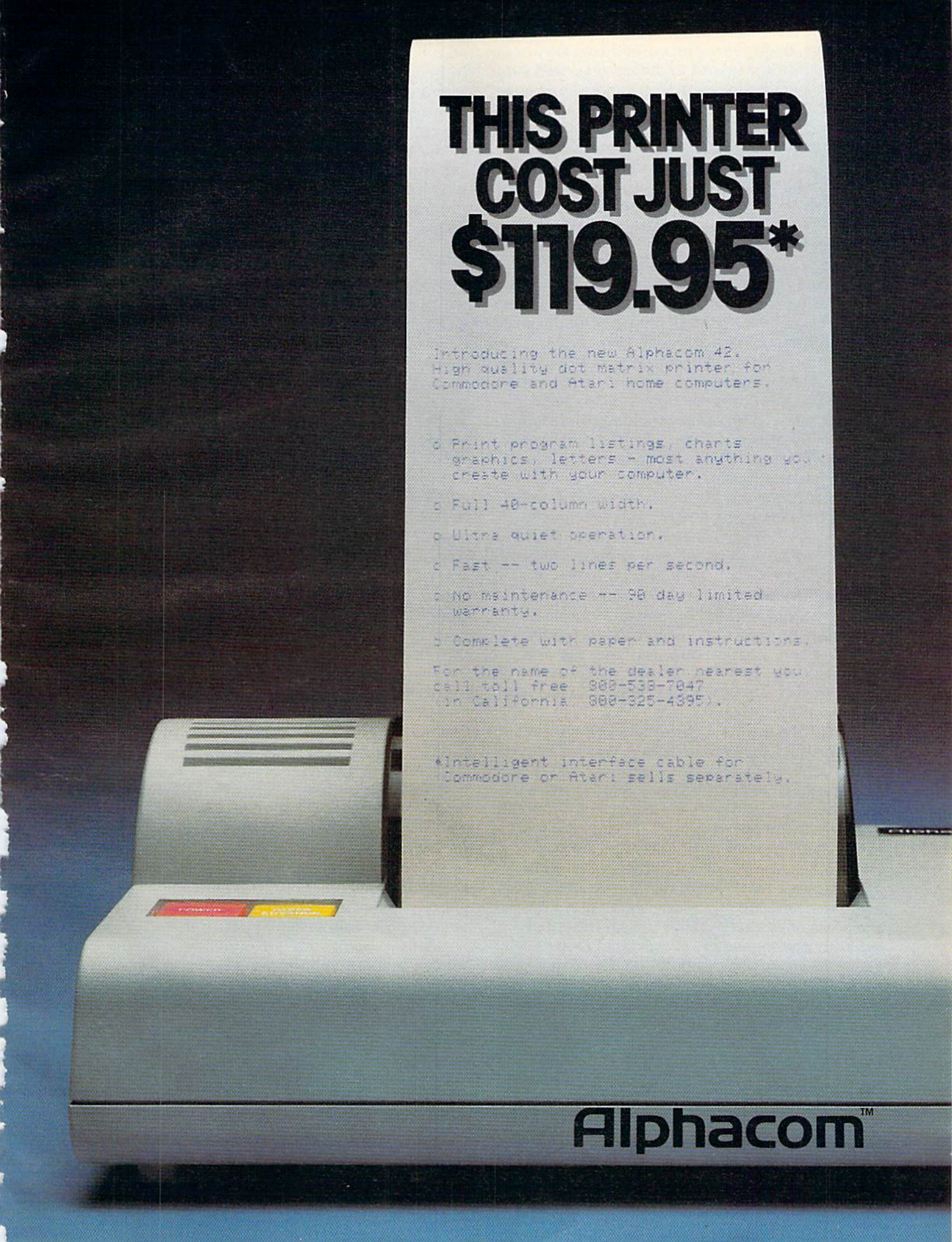
That's why software is such a critical issue in computing. In fact, if someone shopping for a computer has a certain application in mind, it often makes more sense to find the proper software first, and then buy whatever computer it takes to run it. Unfortunately, some people take the opposite approach and wind up disappointed.

There are two main types of software for computers – and one of them is almost invisible to most users. Computer professionals, those who work with the big machines, refer to these two types as *application software* and *system software*.

You're probably very familiar with application software. This includes virtually any kind of program you can run on a computer: games, word processors, educational programs, spreadsheets, graphics and sound demos, you name it. Diverse as they appear, they share one characteristic in common – they allow the user to do something with the computer, to accomplish some purpose, whatever that purpose may be.

On the other hand, you might be somewhat less familiar with system software. You might not even know it exists at all. That's because system software runs "in the background," so to speak, performing housekeeping and other chores with little or no attention from the user. Without system software, the computer could not function.

Returning again to our brain analogy, system software is roughly equivalent to the human involuntary nervous system. Every moment of your life, your brain supervises routine housekeeping tasks that keep you alive: it regulates your heart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and lungs, oversees the functioning of every organ from the pituitary gland to the kidneys, and even keeps its own house in order by allocating brain cells for memories and other purposes. Yet, all of these very sophisticated operations – operations that require a roomful of our best machines to duplicate artificially – occur without a single conscious thought. If we had to consciously direct all these operations, we could do nothing else. By regulating these functions in the background, the brain preserves our conscious minds for virtually anything else we care to think about or do.

A computer works almost exactly the same way. System software – in particular, a program called the *operating system* – performs all the small but significant tasks required to keep the computer functioning. Without any conscious effort or perhaps even awareness on your part, the operating system program runs constantly in the background, even when other programs are running. Fortunately, this saves you a lot of tedious work.

For instance, when you save or recall a program from disk or tape, the operating system takes care of the messy details involved in transferring the data to or from the external device. Typing SAVE or LOAD seems simple enough, but only because the operating system is doing all the dirty work. It's sort of like your brain communicating with your arm. You can move your arm with a casual thought, and subconscious areas of your brain handle all the complicated details of coordinating dozens of muscles and tendons. Because we aren't consciously aware of this going on, we take it for granted. So it is with the operating system.

Also like the brain, the operating system allocates memory to maintain order. When you type in a program, what keeps the last line you typed from being stored in the same memory space as the previous line? The operating system. Actually, in this case the operating system is working together with another piece of system software, BASIC. Yes, the BASIC language is a program just like any other, except that it runs in the background. There are other "invisible" programs, too. If you have a disk drive, it requires a *disk operating system*, usually abbreviated DOS. To keep things working smoothly, DOS works hand in hand with the computer's own operating system for input/output operations.

System software, of course, is not written in BASIC (after all, BASIC itself is one of these programs). Instead, system software is written in *machine language* – literally, the language of the machine. Machine language consists of binary coded commands recognized by the CPU. Each type of CPU chip has its own machine language, usually incompatible with others. The CPU does not understand BASIC any more than it understands English. When you run a program written in BASIC, BASIC translates or *interprets* each command for the CPU, converting it into machine language. Usually this happens much faster than we can notice. However, very complex programs – such as fast-action games with lots of animation – can run very slowly if written in BASIC. That's why practically all commercial games and other programs are written directly in machine language. This is harder than programming in BASIC, but since the computer doesn't have to interpret each command, execution is hundreds or even thousands of times faster.

If you are interested in learning more about machine language, see "Machine Language For Beginners," a regular column in COMPUTE!'s Gazette.

If the operating system, BASIC, and DOS are programs, you may be wondering why you can't recall ever loading these programs into your computer.

Remember RAM and ROM? System software is usually permanently burned into the ROM chips – the ones that never forget. Whenever you switch on the computer, these programs are up and running automatically. But this is only for convenience. It's important to realize that the computer's memory could consist entirely of RAM, in which case you'd have to manually load the operating system and BASIC from disk or tape each time you switched on the computer, just as you do with any other program.

In fact, this configuration is possible with the Commodore 64. It has 64K of RAM, and some of this RAM space is normally overlaid with ROM (which is why there is only about 39K of RAM free for programming). A few POKEs can disable the ROM and give you the full 64K of RAM to play with – but your program will have to take care of all the complex housekeeping once handled by the now-absent operating system. And since BASIC is gone, too, your program must be written entirely in machine language. Only the most advanced programmer can handle this.

So, if system software is analogous to the human involuntary nervous system, it's easy to see why application software is comparable to the brain's conscious thinking. Freed by the operating system and other background programs, the computer can focus the remainder of its power on executing whatever application program you care to run – anything from the most sophisticated data base to *Space Invaders*. The brain-computer analogy shouldn't be carried too far, but it's safe to conclude that, like a brain, a computer will appear only as "intelligent" as whatever is on its mind.

FROM AdVENTURES

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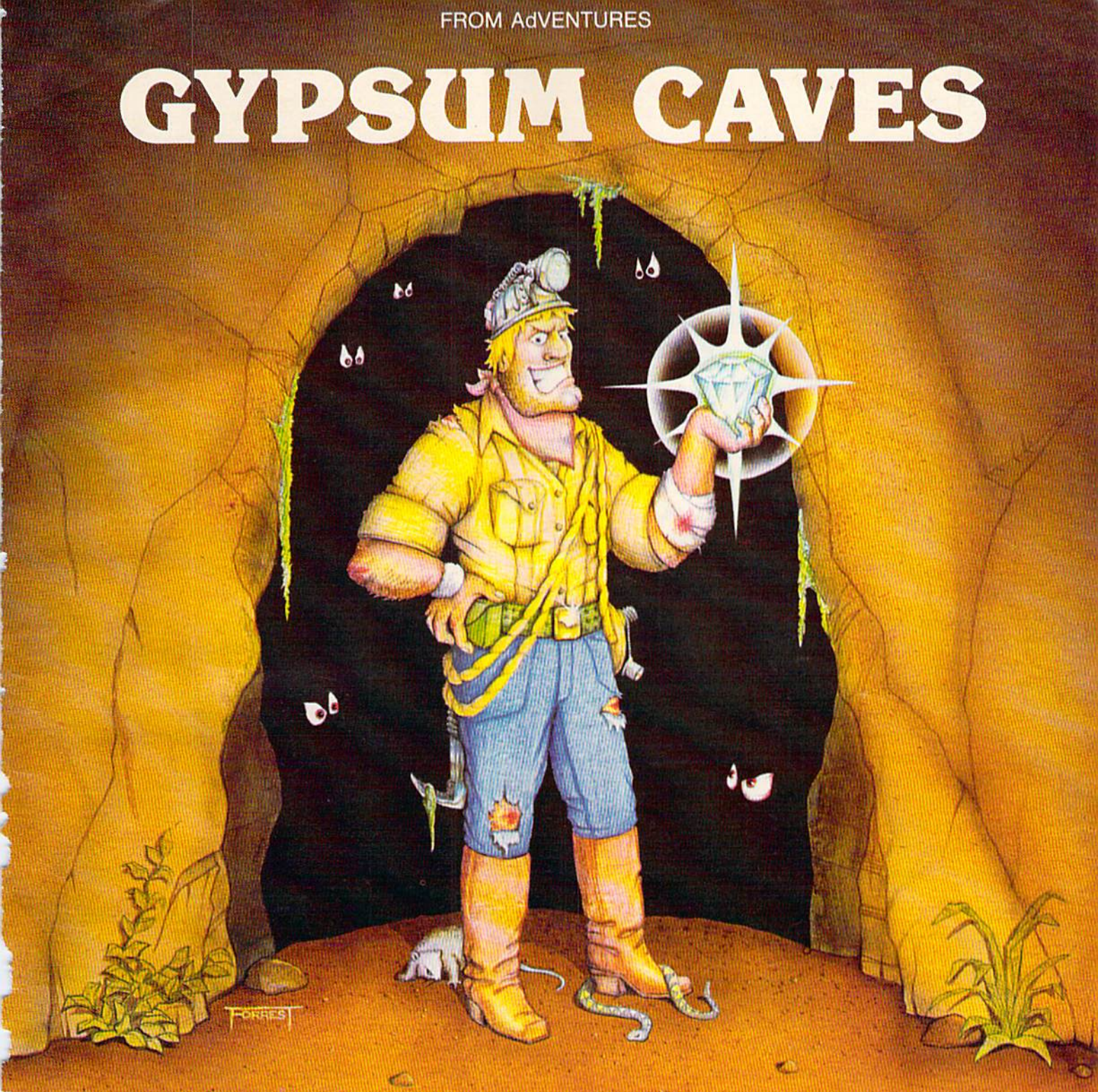

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TELEGAMING Today And Tomorrow

John Blackford

"Telegaming" means playing computer games with two or more computers linked electronically, usually over phone lines with modems. Already, there are telegames which dozens of enthusiasts can play at the same time, exchanging moves across the country. But as home computers grow ever more powerful, and as data communications speed up, what's in store? The immediate prospect: improved versions of existing games. On the horizon: wholly new concepts in telegaming.

Jommy's tendrils twitched in irritation – someone was trying to interfere with him, someone who knew his true identity. His irritation grew to worry, then fear. He'd been in the underground for three years without discovery. *How* could ... *who* could have leaked the secret that he was a member of the telepathic super race of Slans, part human, part mutant?

Jommy's worry grew intolerable. When he could stand no more, he uttered the words that he somehow knew had saved him before. He whispered: *GAME END.*

He felt the familiar blackness, the dizzying sense of dislocation. As his eyes cleared, he recognized the small room piled with baseball gear and the yellowing paper copies of his father's old computer magazines. A familiar voice was calling: "John, John Cross, you take off those vidphones and get in here for dinner this minute."

You probably won't see a game such as *Slan* anytime this side of 2001, but advanced telegaming is definitely on its way. With the number of home computers in the United States at four million and rising fast, there's a growing pool of computerists who are searching for new uses for their equipment. Telegaming could attract many of them because it allows people to communicate with others over great distances – through the medium of their computers.

A game such as *Slan* would be the ultimate in videogaming – a convincing simulation of reality, with a complete town or even nation in high-resolution graphics as the playfield. Each character in the game would have a unique personality created by artificial intelligence programs. Some would be computer-generated automatons. Others would be game players who, within the bounds permitted by the character, would be free to act as they pleased in the game world.

Computers linked via high-speed data lines could display the game action to your eyes through special "vidphones." Sound exciting, or kind of scary? Let's hope there'll always be an OFF switch in case the illusion gets *too* real.

But telegaming today is ages from anything like that – it's still in the horse and buggy stage. Today's game designers are thinking not so much of what can be done someday as what can be done tomorrow.

Despite all the recent advances in computer technology, we are still only a few years past the times when the first computer games were furtively played late at night on university and cor-

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The VIC-20 is a versatile computer. Its programmable color, graphics, and sound can add a lot to game programs.

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Deflector — A ball is bouncing around the screen. You can aim it toward targets by strategically placing deflectors that change its direction.

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Outpost — Your small fortress is under siege. You have two types of lasers and some torpedoes. Unfortunately, the energy supply is dwindling and the computer is on the blink. The supply ship may (or may not) show up in time to make repairs.

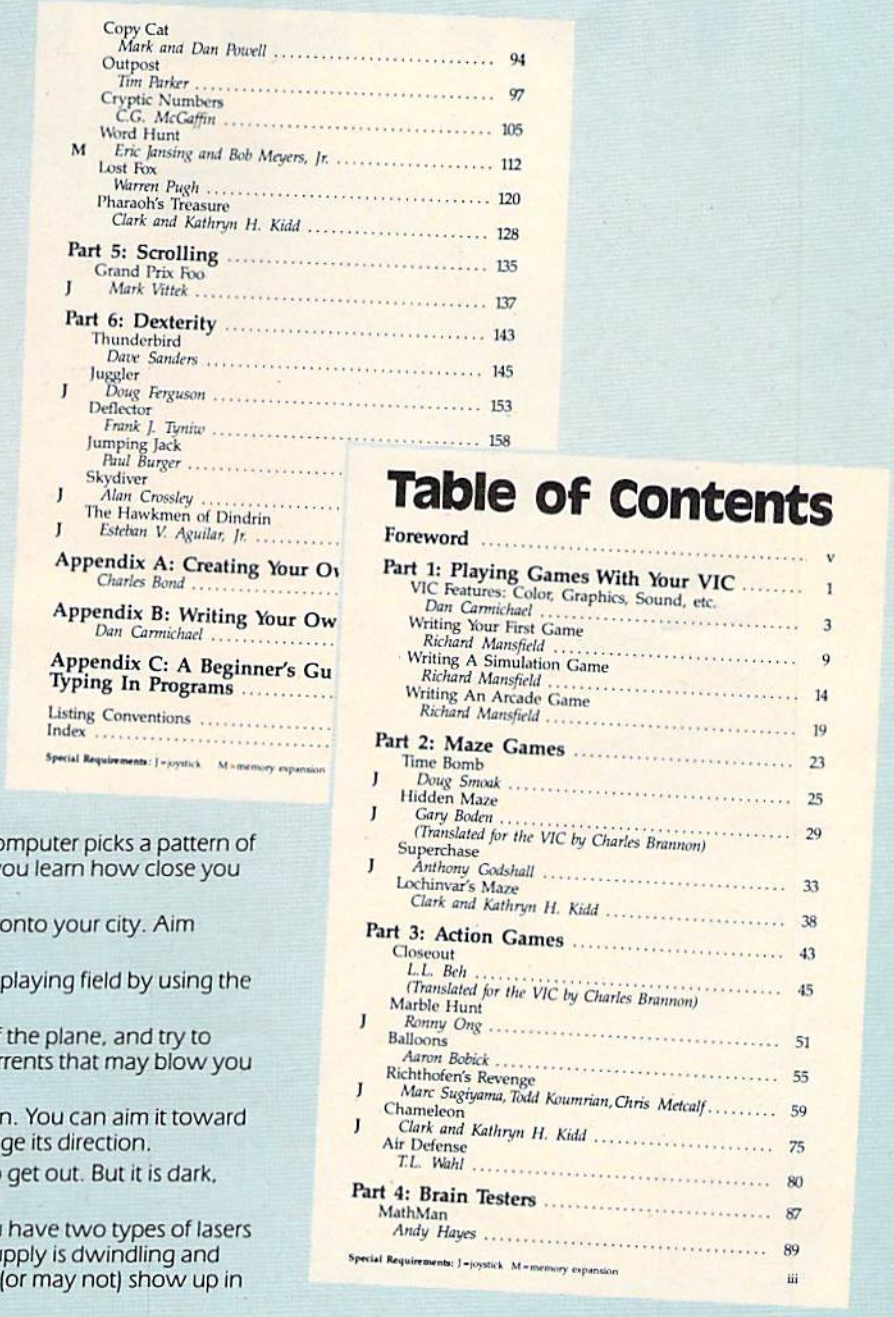

Table of Contents

Foreword v

Part 1: Playing Games With Your VIC 1
VIC Features: Color, Graphics, Sound, etc.
Dan Carmichael 3
Writing Your First Game
Richard Mansfield 9
Writing A Simulation Game
Richard Mansfield 14
Writing An Arcade Game
Richard Mansfield 19

Part 2: Maze Games 23
Time Bomb
J *Doug Smoak* 25
Hidden Maze
J *Gary Boden* 29
(Translated for the VIC by Charles Brannon)
Superchase
J *Anthony Godshall* 33
Lochinvar's Maze
Clark and Kathryn H. Kidd 38

Part 3: Action Games 43
Closeout
L.L. Beh 45
(Translated for the VIC by Charles Brannon)
Marble Hunt
J *Ronny Ong* 51
Balloons
Aaron Bobick 55
Richthofen's Revenge
J *Marc Sugiyama, Todd Koumrian, Chris Metcalf* 59
Chameleon
J *Clark and Kathryn H. Kidd* 75
Air Defense
T.L. Wahl 80

Part 4: Brain Testers 87
MathMan
Andy Hayes 89

Special Requirements: J=joystick M=memory expansion iii

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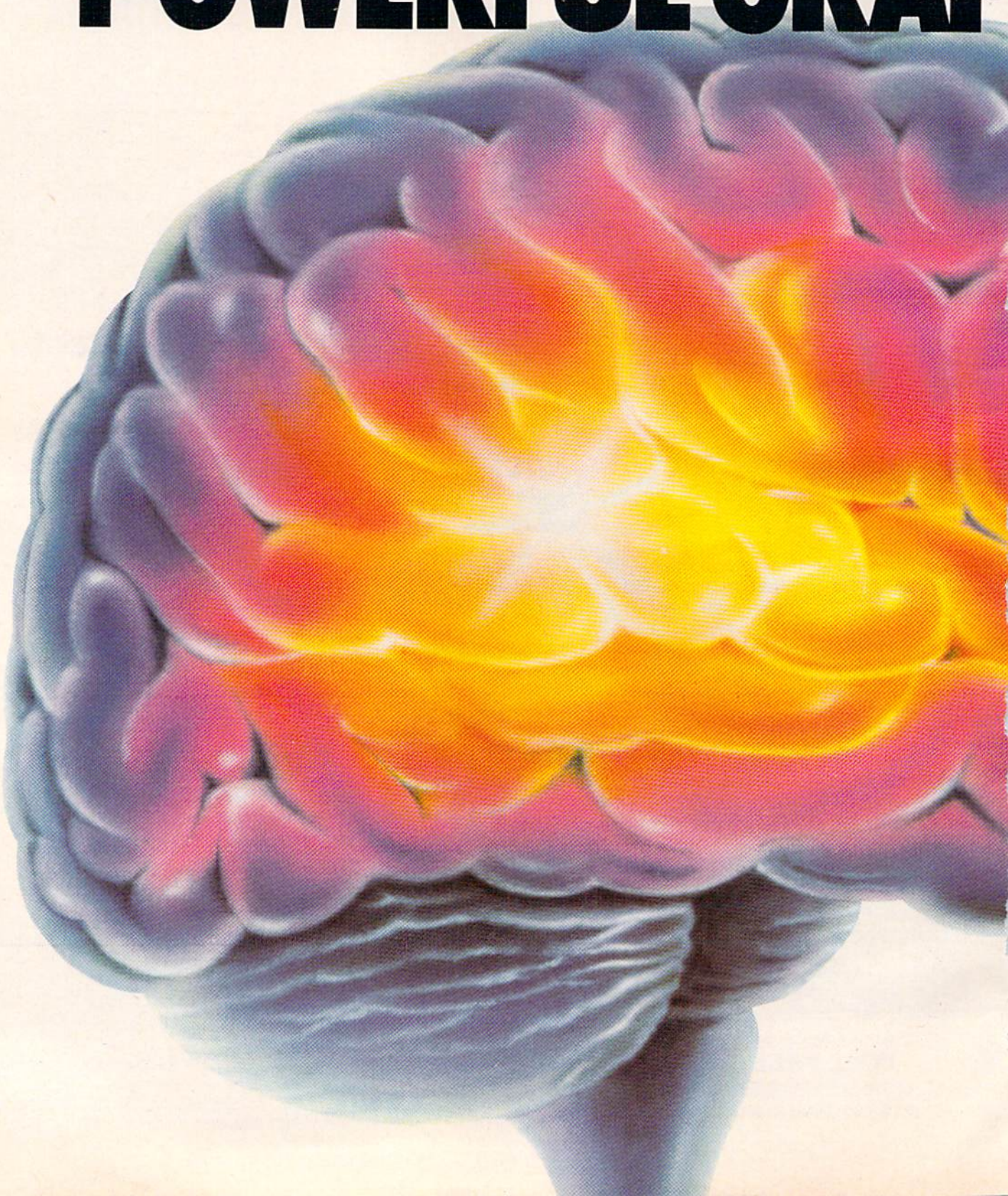

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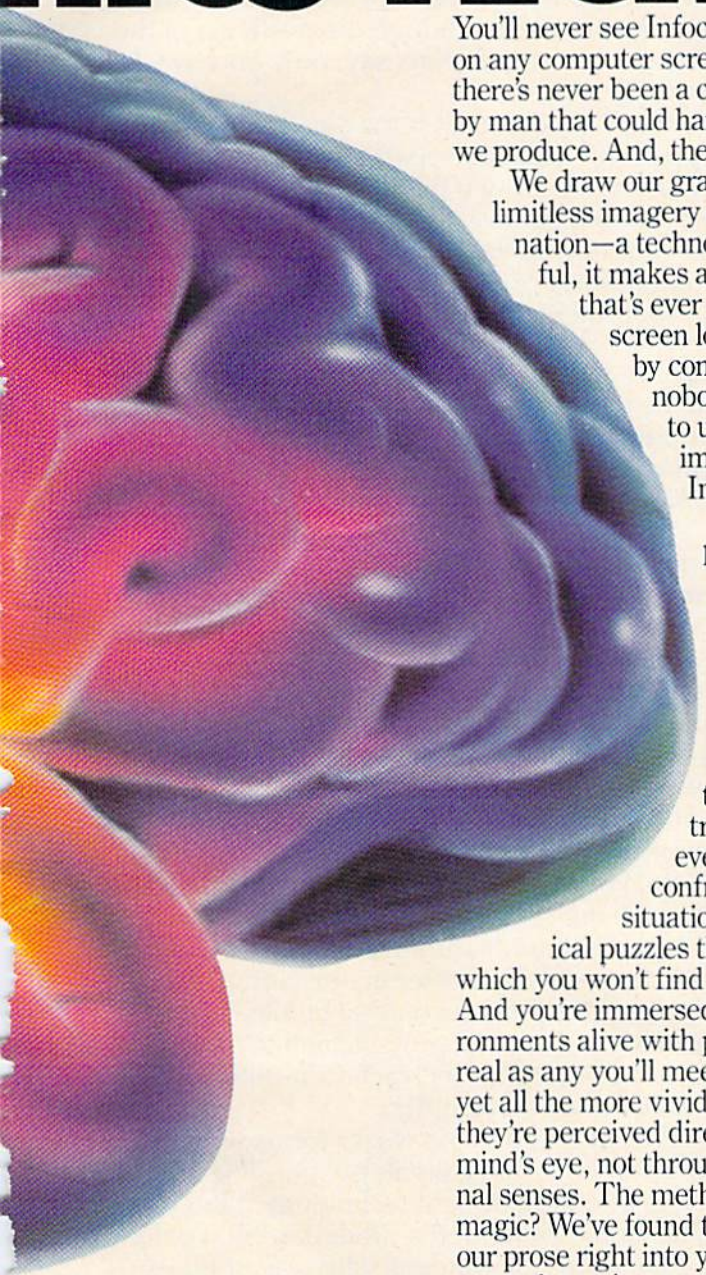

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porate mainframes. At first, even TV-type monitors were rare; the early text-only games were played out on terminals which used paper printouts instead of screens.

Later, minicomputers began to find their way into small businesses, and enterprising people – who may once have played *Star Trek* on campus – began selling computer time to eager game players. Some of these games were the ancestors of telegames, and they worked like this:

You would order a game by mail or purchase it in a store. The package included a rule book and a mailing address. By a certain date, you mailed in your move. The game company collected the moves made by players around the country and ran the game program on their computer with all the new moves added. The computer printed out the results, and the results were mailed back to all the players – who then sent in the next move.

People will become extremely agile in interfacing in hundreds of ways with games achieving total physical involvement.

And so the game would proceed, in ponderous two-week or monthly steps, a remarkable combination of high-tech and old-tech.

These kinds of games still have their adherents, and a company by the name of Flying Buffalo has been running them for 13 years, growing all the while. Based in Scottsdale, Arizona, Flying Buffalo now has several thousand players around the United States engaged in an increasing number of games. *Star Web*, a space game, is currently quite popular, though *Star Lord*, with its color printouts of each move, is starting to catch on.

Founder Rick Loomis hopes to speed up the games by adding a bit more high-tech. Right now, a small percentage of players send in their moves via "electronic mail," by hooking their personal computers or communications terminals over phone lines into The Source. Loomis wants to increase the percentage and improve the games. "We're looking at a way to call in moves by phone and get updates on moves already made," he says.

Even with electronic mail, games such as those offered by Flying Buffalo proceed slowly. Interest is generated by the strategy involved and the overall concept of playing against scores of opponents. What you miss in action on the screen, you can make up for by getting deeply into the game. Mastering the strategy gives a feel for the game's scope.

However, a game of this type could evolve into a more realistic simulation with the addition of sophisticated screen graphics. Players could study an expanded game area (much larger than a single screen), even though the positions of the game pieces would change, say, only once weekly or monthly.

Altogether different is the arcade-type game; it is played in "realtime" (with instant response), typically by one or two players against the computer. The telegame version could be played on a host computer, such as the mainframes operated by CompuServe, or in concert with another personal computer at a remote location.

"The most exciting possibility is where you get multiplayer games," says Bernie DeKoven, a games designer for the Children's Television Workshop.

At present, the most established games of this type are to be found on CompuServe. In addition to the company's list of single-player games are *MegaWars* and *SpaceWars*, two space games that permit many players at once to interact in realtime. The host computer has a vast 3-D map of space on which it tracks the players. Each player sees only a local sector, but when two or more players come within range of each other, the host computer signals them. They can radio each other, fight, or run.

SpaceWars is better for beginners, because of its streamlined command structure. *MegaWars*, with extensive commands and complex rules, is nearly impossible to master in one sitting. Still, it attracts regulars who become so familiar with the game that they can instantly recognize the user ID of many other players (each CompuServe subscriber has a unique user ID).

"We have a guy who works for us who loves *MegaWars*," says Larry Shelley, CompuServe's manager of entertainment technology. "But every time he would sign on, the other players would recognize his ID as someone who was in-house from CompuServe – and they would gang up on him. If someone got in trouble, he would call in the coordinates of our guy's planet, and people would come in and blow it away."

Shelley thinks this sort of thing is actually one of the reasons for the popularity of multiplayer telegames. Arcade games have instantaneous response and fast action, but are usually played

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in isolation by a single person. "The advantage of multiplayer games is the people-to-people interaction," he says.

Software designer Greg McNickle of Unitronics believes telegaming can support "love relationships, friendships, everything." He says, "Imagine you've drawn something on the screen that you like – and it goes into a network where others can draw and add to the original image. So you have two or more individuals who are relating to each other's art and thus are invited toward each other – maybe to get in touch in person."

The main hindrance to telegames now isn't a lack of willing players, but a lack of money. Equipment is expensive. An information service must purchase powerful computers, defraying the cost with subscriptions and connect fees. Creating new types of games may require new equipment, improved communications lines, or expensive high-resolution screens for home users. It might even require upgrading the entire telephone system, which wasn't designed for high data volume. "The concept is there," says DeKoven. "But I guess it takes awhile for the technology to catch up."

Another problem is the lack of standardization between computer types. "Software should be compatible between machines," says Terry Bradley, a vice president and co-founder of Sirius Software. He hopes the next generation of home computers will have standard voice and graphics chips to aid the transfer of games between machines. "Right now it is a tiny market," says Bradley. Sirius will write software for telegaming once the market develops, he says, but the company isn't out to create the market.

One company that is already selling telegaming software is Adventure International. The game, *Commbat* is a tank battle that's played between two home computers equipped with modems. The unique thing about it is that people with different computer types can still play one another. Each player loads a version of *Commbat* designed for the particular computer. Because the commands are standardized, different versions can communicate via phone, allowing the players to engage in a realtime battle with simple graphics.

To get around the limitation of slow data transfer over phone lines, designers are searching for fresh ideas that won't require exorbitant cash outlays. CompuServe recently announced an improved type of multiplayer game that has color graphics and true perspective. If the enemy's ship flies across your bow, you'll see it flash across your screen – but his view will show your ship moving away on the left side of his screen. If you accelerate, objects will begin to pass by more rapidly. CompuServe's Shelley says all this takes place at a leisurely transmission rate of 300 baud. The secret, he adds, has to do with getting objects to move on the various screens without sending graphics information over the phone lines – which would slow the pace to a crawl.

Simutron, of Vista, California, plans to get around the telephone bottleneck by eliminating it from their system. Instead, the company has designed a franchise system to distribute such games as *Star Trek*, licensed to them by Paramount. Each franchise would contain 16 to 32 intelligent terminals tied to an on-site computer. Action would be fast, arcade-quality, and completely shared among the terminals. High-quality computer graphics backed by special effects from videodiscs would combine to form a multiscreen presentation at each player's station. There's even a provision for voice and video communication among stations. You can call up your Klingon enemies in the heat of battle (and see their ugly faces) to discuss surrender terms.

"We feel we are taking one of the first steps toward the electronics of the future," says Simutron marketing director Dave Jenkins. The system is essentially complete, the interior design of the franchise outlets is finished, and the final touches are being added to the computer graphics. The holdup, again, is capital. People are excited by the idea, but are reluctant to put up money for such a new concept. Right now, Simutron is negotiating to combine the centers with the restaurants of a large chain.

If the effort does get off the ground, Jenkins says Simutron could hold national tournaments, using special high-speed communications links between centers. The cost of this would rule out a permanent hook-up, and besides, Jenkins thinks people would rather play with their friends than a stranger in another city.

Another way to get around the expense of topnotch telegames is to open them up to audience participation. DeKoven envisions a sports analogy where some game players would become expert, or even go professional. Viewers around the country could tune in for a fee to watch their favorite videogame stars do battle in high-resolution graphics. "People could follow the games on their screens, perhaps even interact in some way – possibly inform a player of danger," he says.

At the expert level, players could control the game on many levels – heart rate, alpha brain waves, and eye movement might each control different aspects. "People will become extremely agile in interfacing in hundreds of ways with games," says DeKoven, achieving "total physical involvement."

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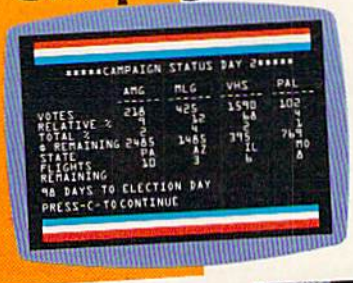

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Downloading Games:

A Step Toward Telegaming

Phone lines can be used to distribute games as well as play them. Games and other programs can be *downloaded* from a remote computer to the user's personal machine. This has some advantages. When you play the game on a host computer, you pay an hourly fee for connect time, the time actually spent on-line. But if the game is downloaded, you can play it at your leisure.

Establishing this two-way link for distributing software may be an intermediate step toward full-fledged telegaming. For although it will be some time before sophisticated realtime telegaming is practical in the average home, downloading software on a mass scale is possible today.

"What the consumer will experience most readily is downloaded software," says Bernie DeKoven, games designer for the Children's Television Workshop. DeKoven feels that many of the possibilities in telegaming require too much expensive technology to be likely to succeed in the immediate future.

Several companies are readying plans to distribute games and possibly other software over the phone system. Control Video Corporation recently announced plans to sell a modem that plugs into the Atari 2600 video game machine (of which there are about 11 million in American homes). The service, called Gameline, would transmit popular games for a fee. The game programs have built-in counters limiting their use to a certain number of plays. After the allotment is used up, the game stops working. This keeps the retailers happy, because people who like the game can still purchase a permanent version locally.

Downloaded software could be distributed in other ways, too. Cable TV makes a good medium for transmitting games because coaxial cable carries a tremendous amount of data – making possible games with superior graphics. Since game graphics eat up so much memory, a delivery system employing low baud rates (transmission speeds) would take much too long to download extended graphics. Not so with cable.

Starting December 1, some cable TV customers will be able to subscribe to the Games Network, a new system for downloading computer games into homes. For $14.95 a month, subscribers will lease an Apple-compatible terminal with 64K of memory. A menu of 20 to 40 games displayed continuously on the TV screen will show what's available. Each month, the selection is updated with new games.

To receive a game, you type a choice on the terminal, and the Games Network transmits the program through the cable. The program is sent in coded form during the *vertical blanking interval*, the split-second that elapses between frames on the TV set (visible as a black horizontal bar that rolls up or down your screen when the vertical hold is out of adjustment). By sending the game during the blanking interval, the broadcaster avoids disrupting the menu display. As the signal comes in, the terminal decodes it, and the game is ready to play. It cannot be stored permanently, however – it must be downloaded for each playing session.

This kind of two-way cable has many possible applications. Several power companies are even looking at the technique as a means of reading meters without having to send anyone out to a customer's house. Since the power companies could save considerable sums this way, there's more incentive for two-way cable. And that could spread such offerings as the Games Network.

Another possible means of distributing games is over FM radio. "The FCC has released so many new bands for FM, it's now possible to devote stations to the continuous broadcast of games," says Terry Bradley, a vice president and co-founder of Sirius Software. The station could repeatedly broadcast its entire selection of games, day and night. Using a "radio modem" and decoder, the computer could locate the desired program, decode it, and store it in memory for later use.

But Bradley suspects this type of mass distribution would be vulnerable to airwave piracy. If the radio modem/decoder could be copied fairly easily, anyone could receive the signals, not just subscribers. "There's no way to control it," he says. "It's like satellite TV."

Bradley thinks one solution would be to program commercials into the games – perhaps during the intermissions between levels.

But none of this will take place – according to scientist and futurist Robert Jastrow – "until fiber optics get into the home."

Why fiber optics? Fiber optics are bundles of glass fibers through which light can be flashed, transmitting massive amounts of data at stupendous rates. In some cities, slender fiber optics are replacing bulky copper cables for telephone trunk lines, though it could be the end of the century or beyond before fiber optics enter the home. When they do, data transfer will jump from hundreds of bits per second to megabits.

At that point, audio communication changes to video all over the country," says Jastrow. "People will be able to communicate by video in realtime, which will have a really decentralizing effect on our country. We'll return to the old idea of the cottage."

Thus, we may be headed for an era when work, shopping, information gathering, and recreation will all be centered around the home – borne on flickering threads of light. "Pretty soon our society is going to get on a real information high," says Sirius's Bradley. "Now, man is so mobile. We just hop around this planet. But we are using up our resources. The home is going to be designed more for pleasure, and people will spend more time at home."

Such an era would be conducive to telegaming. With powerful computers in every home and communications lines capable of flashing photo-quality images and graphics around the world, massive nationwide or worldwide tournaments could flourish. If you wished, you could follow the action around the globe, watching, as hour by hour new players awoke fresh from a night's sleep and signed on to play.

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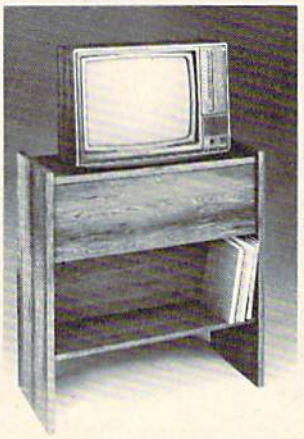

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HOTWARE

A Look At This Month's Best Sellers And The Software Industry

Kathy Yakal, Editorial Assistant

Commodore 64 Entertainment

This Month		Last Month
1	*Jumpman* (Epyx)	1
2	*Zork I* (Infocom)	2
3	*Frogger* (Sierra On-Line)	–
4	*Temple of Apshai* (Epyx)	3
5	*Zork II* (Infocom)	–
6	*Repton* (Sirius)	–
7	*Gridrunner* (HesWare)	–
8	*Turmoil* (Sirius)	–
9	*Zork III* (Infocom)	10
10	*Deadline* (Infocom)	–

Commodore 64 Home/Business/Utility

This Month		Last Month
1	*WordPro 3 Plus/64* (Professional)	1
2	*HES Mon* (HesWare)	–
3	*Data Manager* (Timeworks)	2
4	*Money Manager* (Timeworks)	2
5	*6502 Professional Development Kit* (HesWare)	–
6	*Personal Finance Assistant* (Rainbow)	–
7	*HES Writer* (HesWare)	6
8	*Household Finance* (Creative)	–
9	*Inventory 64* (Computhings)	–
10	*TOTL.Text* (TOTL)	5

Commodore 64 Educational

This Month		Last Month
1	*Kinder Comp* (Spinnaker)	2
2	*Facemaker* (Spinnaker)	3
3	*Hey Diddle Diddle* (Spinnaker)	4
4	*Touch Typing Tutor* (Taylormade)	5
5	*Coco* (HesWare)	1

VIC-20 Entertainment

This Month		Last Month
1	*Choplifter* (Creative)	1
2	*Graverobbers* (Victory)	–
3	*Gridrunner* (HesWare)	3
4	*Shamus* (HesWare)	2
5	*Adventure Pack I* (Victory)	–
6	*Annihilator* (Victory)	–

VIC-20 Home/Business/Utility

This Month		Last Month
1	*Household Finance* (Creative Software)	5
2	*HES Writer* (HesWare)	3
3	*HES Mon* (HesWare)	–
4	*Home Office* (Creative)	2
5	*Turtle Graphics* (HesWare)	1
6	*TOTL. Label* (TOTL)	–
7	*6502 Professional Development Kit* (HesWare)	7
8	*Quick Brown Fox* (Quick Brown Fox)	–

VIC-20 Educational

This Month		Last Month
tie	*Computer Coach* (BEST)	–
tie	*Type Attack* (Sirius)	–
2	*Touch Typing Tutor* (Taylormade)	3
3	*Flash 'n Spell* (Qumax)	5
4	*Flash 'n Math/Multiplication* (Qumax)	–

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Software for the VIC 20 ™
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This month we examine some of the factors that either make a software product a best seller or banish it to the bargain bins. We're also continuing to look at some of the trends that have emerged over the summer.

You've probably seen numerous best seller lists for books, movies, records, TV shows, and other forms of entertainment. Usually they stay almost the same for weeks or even months on end as you look in vain for any significant changes. "Geez, when is that Wayne Newton album going to move up from No. 39? It's been there for weeks!" Or, "Why doesn't someone knock that Richard Simmons book out of first place?"

Not so with home computer software. For a number of reasons, a game that was on top of the list one month can fall right off the charts the next. And vice versa. What are the reasons?

Availability/Visibility. Say there's this great game made by a small company with very little funds for marketing and even less for advertising. The company could try to get some local stores to sell it or make it available by mail order. Both of these methods work, but chances are not good that it would get the exposure necessary to really make it move.

Now let's say the game is bought by someone who works for a major distributor. The distributor sees it, starts to carry it, recommends it to his retailers, and (if it's truly a great program) suddenly it starts selling. The effectiveness of marketing and distributing, especially in a still-maturing market such as home computer software, is tremendously important. Visibility and availability are absolutely essential to success.

Technical Problems. Again, because this is still a very young industry, there are a number of technical problems related to both hardware and software that affect the market. If a computer undergoes a series of upgrades that subtly change certain operating characteristics – as the Commodore 64 has – a game programmed for one model may not work properly on another. Technical problems can also affect supply of software. One distributor complained last month that he could not get a single copy of one of the current best sellers because the manufacturer was having trouble with cartridge production. This had a definite impact on the HOTWARE list.

Other Factors. Various other things may influence a program's market performance: whether its visual impact leads individual retailers to run demo copies on computers in the store; the quality of the program's packaging; the reputation of the software publisher; "word of mouth" advertising, especially through user groups; pricing; and even, to some extent, best seller lists such as HOTWARE.

Sophisticated Packaging

We're beginning to see a higher level of sophistication in the way software, particularly game software, is being packaged. A good example is Infocom, which was singled out by one distributor we contact every month. Electronic Arts, a new company whose games have not yet appeared on the HOTWARE list, is another.

Educational Software

Educational software is beginning to pick up. In spite of all the computers being used in classrooms these days, and for educational purposes in the home, educational software does not seem to move as well as games or business/utility programs. For one thing, there has been much less to choose from, especially compared to entertainment software.

Companies such as Spinnaker are changing that. Programs like *Facemaker* and *Kinder Comp* (both of which appear on this month's HOTWARE list) are often praised by our sources. In the first week that one of our sources stocked Spinnaker programs, they outsold all his other educational software combined.

Trend To Strategy Games

Racking up 100,000 points or gobbling up all the little dots or saving Earth is a heroic accomplishment, but based on the sales trends we're seeing, gamers are looking for challenges that involve more brains and strategy. This is not to say that action games are out; they will always have a following. But strategy games are definitely moving in.

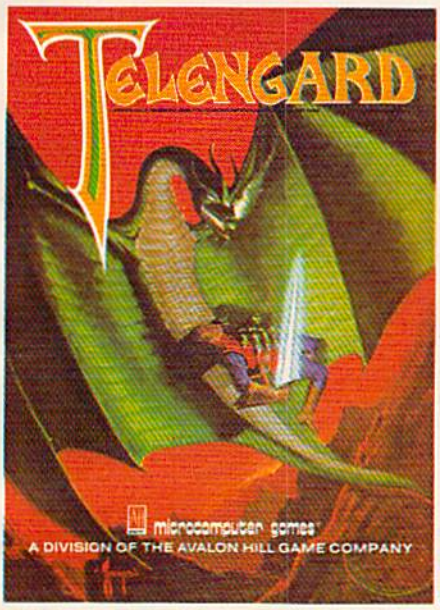
Commodore 64 HOTWARE

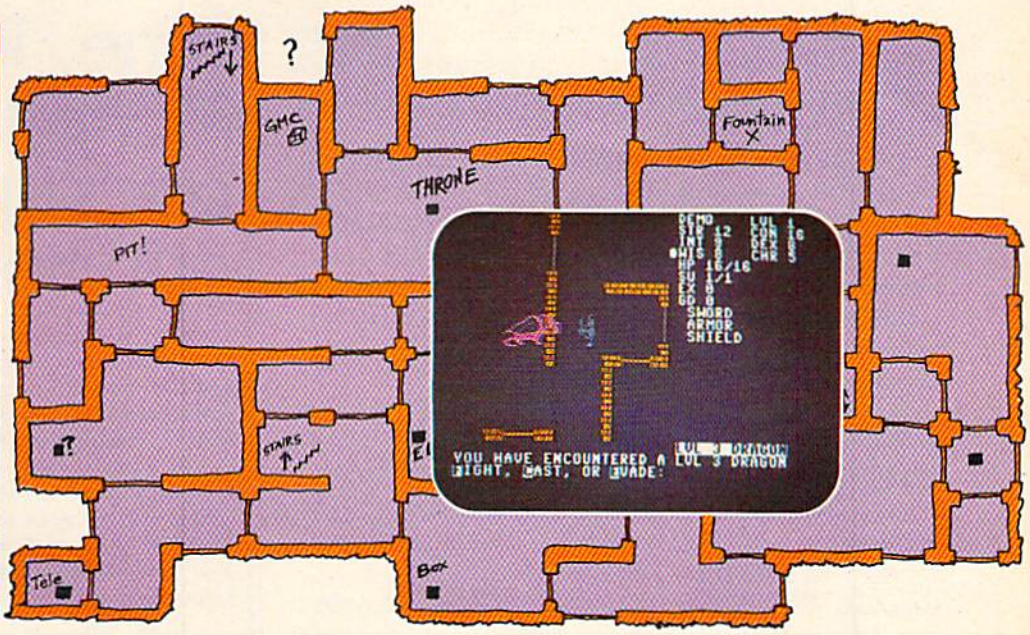
Jumpman and *Zork I* continue to hold first and second place in the entertainment category. *Temple of Apshai* slipped to fourth place, and its former third-place position was snapped up by a new entry this month: Sierra On-Line's *Frogger*.

Sirius Software is creating some competition for Epyx and Infocom, which have been dominating our HOTWARE list. Last month's *Fast Eddy* and *Squish 'em* dropped off the list this month, but were replaced by *Repton* and *Turmoil*. HesWare's *Gridrunner* is back on the list again, taking the No. 7 position.

In the home/business/utility category, *WordPro 3 Plus/64* retains its No. 1 position, in spite of all the competition coming into play. New Commodore 64 owners are hungry for home/business-oriented programs, and there are plenty of software companies willing to supply them. Timeworks, which had two best-selling games last month, stays on the charts with *Data Manager*

Be Amazed!





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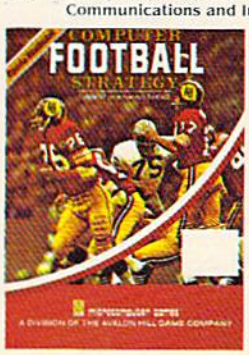

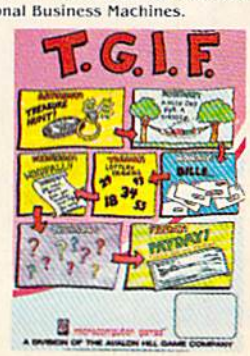

and *Money Manager* in third and fourth place. HesWare is still a strong competitor in this category; it takes second, fifth, and seventh places with *HES Mon*, the *6502 Professional Development Kit*, and *HES Writer*. Computhings, which had a best seller in its *Dome Business* last month, appears again with a program called *Inventory 64*. Rainbow Software debuts this month with *Personal Finance Assistant* in sixth place.

Spinnaker is still producing the best educational software, according to our HOTWARE sources; *Kinder Comp*, *Facemaker*, and *Hey Diddle Diddle* claim the top three spots this month. It appears, though, that Scholastic may be stiff competition for Spinnaker. One of our sources says that Scholastic's packaging is phenomenal, and the programs themselves are excellent.

VIC-20 HOTWARE

It's almost as difficult to get information about best-selling VIC-20 software as it was to get the same information a few months ago about Commodore 64 software. Not for the same reason, though: VIC-20 software *is* available, but people don't seem to be buying as much of it at the same places anymore. Most of our sources are specialty retailers and distributors, and the bulk of VIC-20 software sales seems to be shifting to the discount stores (as discussed in last month's HOTWARE).

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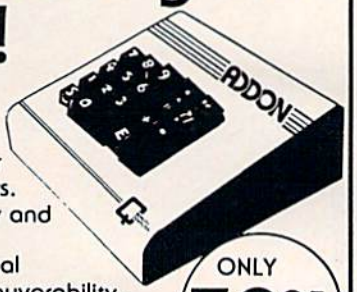

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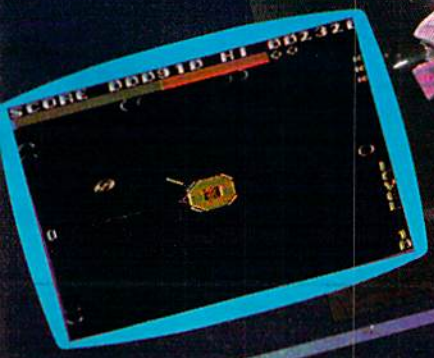
Created by Alan Pavlish



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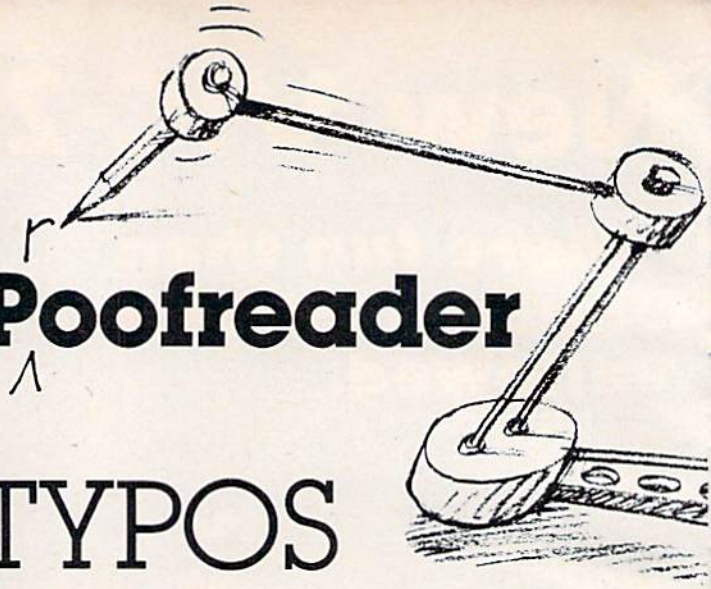


The Automatic Poofreader

BANISH TYPOS FOREVER!

Charles Brannon, Program Editor

The vast majority of letters and telephone calls we receive from readers concern our program listings. Many readers have trouble getting the programs to work. All listings are generated with a computer and a printer directly from fully tested, working versions of the programs, yet many readers continue to experience problems. To solve a lot of frustrations on both ends, COMPUTE!'s Gazette introduces "The Automatic Proofreader" – a revolutionary new way of entering programs that alerts you *instantly* if you've made a typing error.

We all know it's hard to type in a program correctly the first time. Seemingly trivial typing errors can cause dreaded ERROR messages, or even a *system crash* (the keyboard will not respond to RUN/STOP-RESTORE). Usually the only way to recover from such a crash is to reset the computer by turning it off, then on again – wiping out the memory and all your typing in the process.

Even when you locate and correct the mistyped lines, there always seem to be more errors lurking in the hundred-odd lines of the program. Sometimes you feel like giving up.

Elusive Errors

Some errors are almost impossible to spot, especially for beginners who know little or nothing about programming. For instance, can you spot the mistake in this line?

```
100 PRINT RIGHT$("00"+MID$(STR$(V),2,3)
```

Here's how it should read:

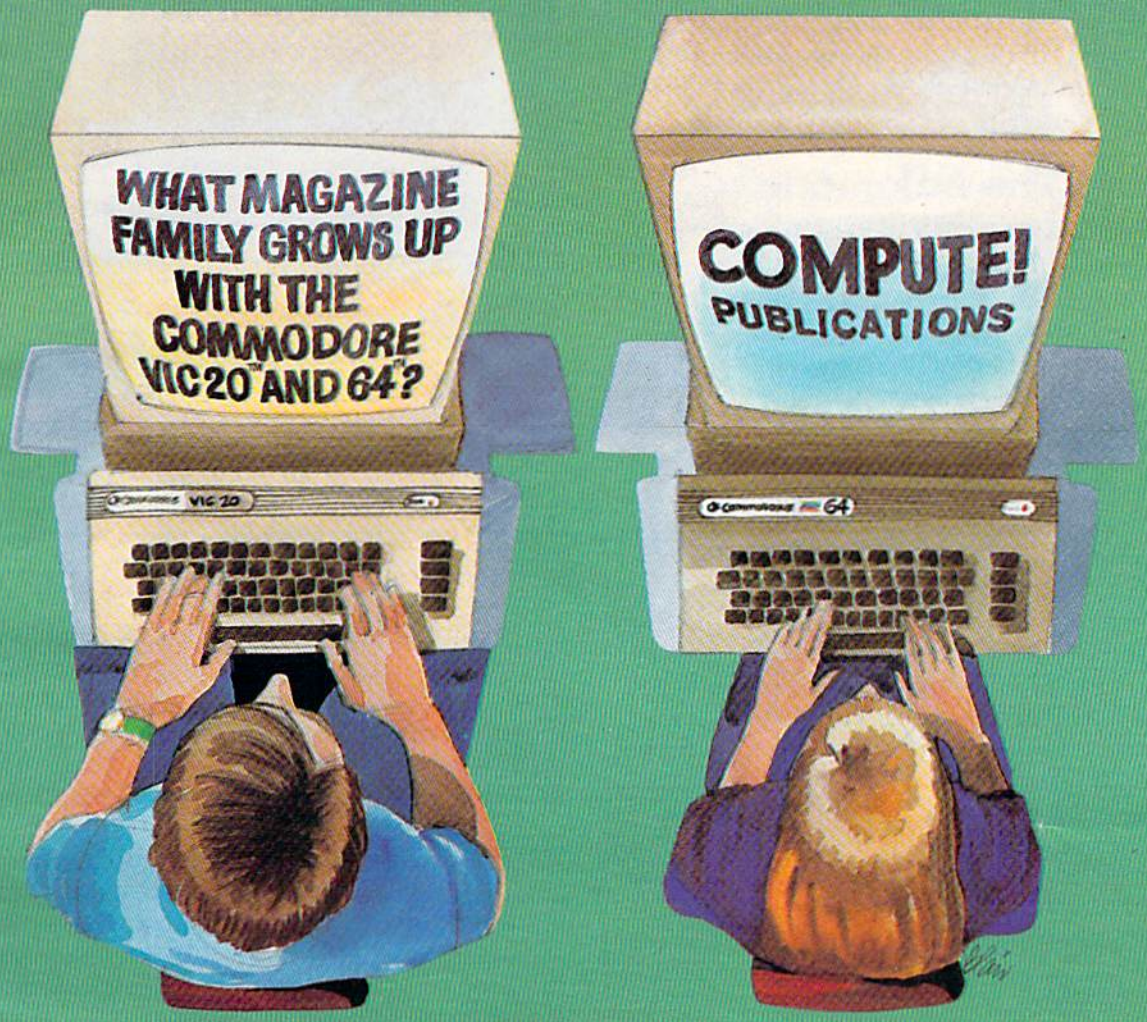
```
100 PRINT RIGHT$("00"+MID$(STR$(V),2),3)
```

Did you catch the difference? A right parenthesis was missing after the number 2. (A left parenthesis must always have a matching right parenthesis. If you add up all the parentheses in a statement, you should get an even number.)

An Impossible Dream?

The strong point of computers is that they excel at tedious, exacting tasks. So why not get your computer to check your typing for you? An impossible dream?

Not with "The Automatic Proofreader." Nestled within your VIC-20 or Commodore 64, the Proofreader automatically checks every line you type in. It displays a number at the top of your screen. This number, called the *checksum*, corresponds to the line you've just typed. It represents every character in the line summed together. A matching number in the program listing lets you compare it to the checksum that the Proofreader displays. A glance is all it takes to confirm that you've typed the line right.



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The Automatic Proofreader is a small machine language program that resides in a relatively safe area of memory, the cassette buffer. It will remain there until you turn off your machine, or run another program that uses the cassette buffer. Loading or saving BASIC programs from tape or disk will not affect it.

Entering The Automatic Proofreader

If you have a VIC, type in Program 1. Program 2 is for Commodore 64 users. There's only one small catch – the Proofreader can't check *itself*, so be extra careful to type it in correctly in the first place. Since it is a machine language program, be especially diligent. Watch out for typing extra commas, a letter O for a zero, and check every number carefully. Fortunately, the Proofreader is a short program, so you should have no trouble.

When you've typed in The Automatic Proofreader, SAVE it on tape or disk at least twice *before running it for the first time*. If you mistype the Proofreader, it may cause a system crash when you first run it. By SAVEing a copy beforehand, you can re-LOAD it and hunt for your error. Also, you'll want a backup copy of the Proofreader because you'll use it again and again – every time you enter a program from COMPUTE!'s Gazette.

When you RUN the Proofreader, the program will be POKEd safely into memory. Then press RETURN on the line the cursor is sitting on to activate the Proofreader. If you ever need to reactivate it, just enter the command SYS 828 and press RETURN.

Using The Proofreader

Now, let's see how it works. LIST the Proofreader program, move the cursor up to one of the lines, and press RETURN. If you've entered the Proofreader correctly, a number will appear at the top-left of your screen.

```
10 A=1:B=72:PRINT"SCORE=";SC :rem 199
                            Checksum
          Don't type this
```

Try making a change in the line, hit RETURN, and notice that the number has changed. All VIC and 64 listings in COMPUTE!'s Gazette now have a number appended to the end of each line, for example ":rem 123". *Don't enter this statement*. It is just for your information. The "rem" is used to make the number harmless if someone does type it in. It will, however, use up memory if you enter it, and it will cause the checksum displayed at the top of the screen to be different, even if you entered the rest of the line correctly.

Just type in each line (without the printed checksum), and check the number displayed at the top of the screen against the checksum number in the listing. If they match, go on to the next line. If they don't, there's a mistake. You can correct the line immediately, instead of waiting to find the error when you RUN the program.

"Automatic Proofreader" displays a checksum number in the upper-left corner of the screen that tells you immediately if you've typed a program line incorrectly. Just compare the checksum to the REM number in the printed listing.

The Proofreader is not picky with spaces. It will not notice extra spaces or missing ones. This is for your convenience, since spacing is generally not important. But occasionally proper spacing *is* important, so be extra careful with spaces, since the Proofreader will catch practically everything else that can go wrong.

There's another thing to watch out for: if you enter the line by using abbreviations for commands, the checksum will not match up. But there is a way to make the Proofreader check it. After entering the line, LIST it. This eliminates the abbreviations. Then move the cursor up to the line and press RETURN. It should now match the checksum. You can check whole groups of lines this way.

When you're done with the Proofreader, disable it by pressing RUN/STOP-RESTORE (hold down the RUN/STOP key and press RESTORE). If you need it again, enter SYS 828. It will then be ready once again to act as your personal typing aid.

Checksum programs are not new in computer magazines. But until now, there was nothing like The Automatic Proofreader – it shows you *instantly*, as soon as you've entered the line, if you've made a typo. We hope that the proofreader makes your program entry both faster and easier, and that you'll never have to face another frustrating ERROR message.

See program listings on page 145.

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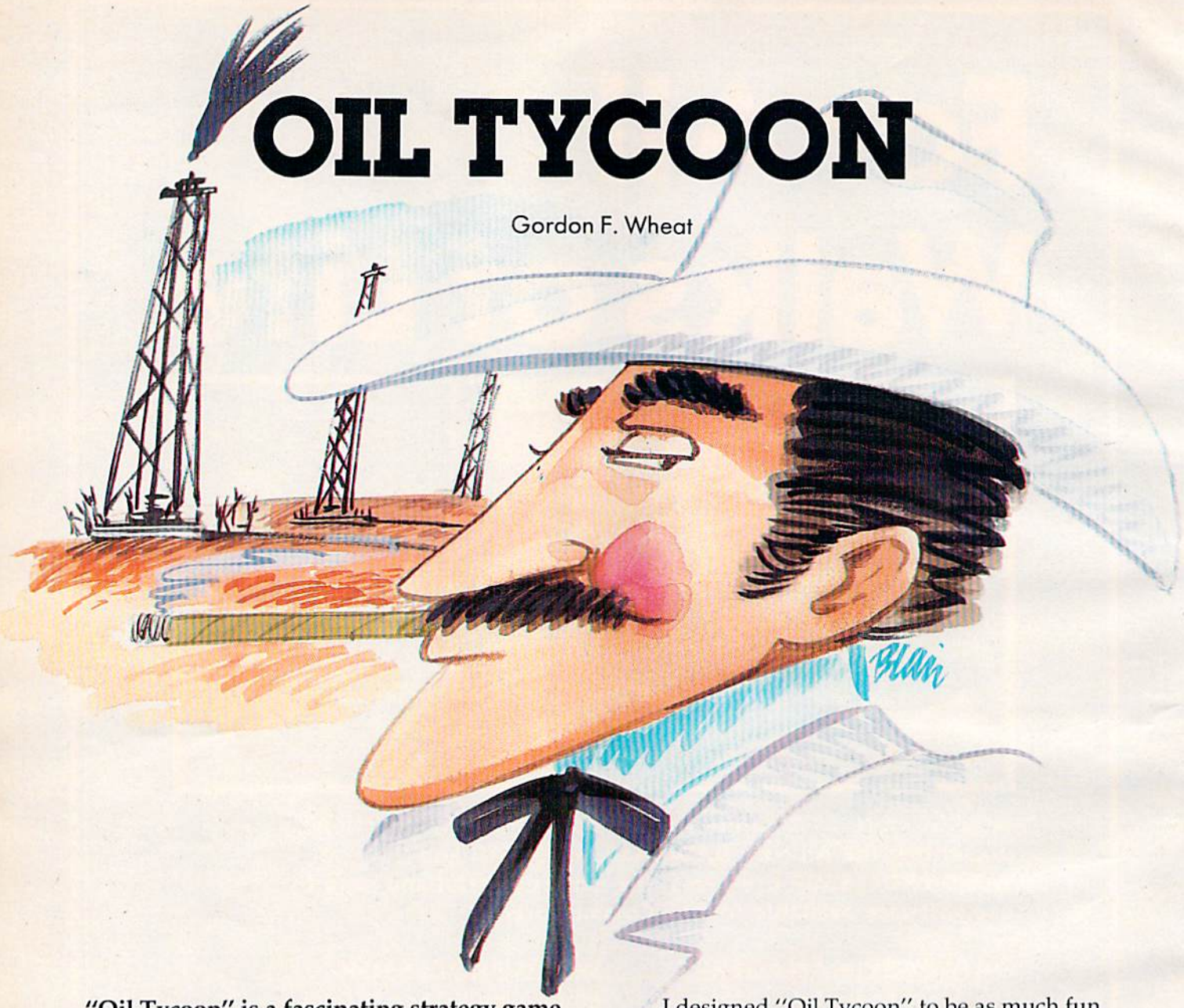
OIL TYCOON

Gordon F. Wheat



"Oil Tycoon" is a fascinating strategy game with multiple difficulty levels and hundreds of play possibilities. For the unexpanded VIC and the Commodore 64. It requires one joystick.

You are P. J. Uing and you are about to make big money in the petroleum business, but drilling for oil is not as easy as it sounds. There are obstacles you must overcome in order to make a profit. There are shale formations that grind away your pipe. You can blast through them, but your dynamite is limited. Pockets of natural gas sometimes collect where you have previously pumped out the oil. Hit one of these and your oil rig goes up with a bang. There are also "devils" that live in the oil. They take a dim view of your draining their caverns. But you won't give up – because you are the Oil Tycoon.

I designed "Oil Tycoon" to be as much fun for parents as it will be for children. Since the game is not based on reaction time but rather on strategy, it helps even the score for the "arcade dropouts." Your strategy will slowly build, and before long you will be rolling in cash or attaining high scores, however you wish to look at it.

Loading Procedure

Oil Tycoon will run on an unexpanded VIC, and there's another version for the 64. The VIC version fits in 5K of memory because it is actually two separate programs. The first program displays a brief review of the control features and a few simple warnings, along with the message "PLEASE WAIT FOR FURTHER INSTRUCTIONS." At this point it POKEs into memory the custom character information and the machine language portion of the game used for reading the joystick position. It protects this area of memory from BASIC, then

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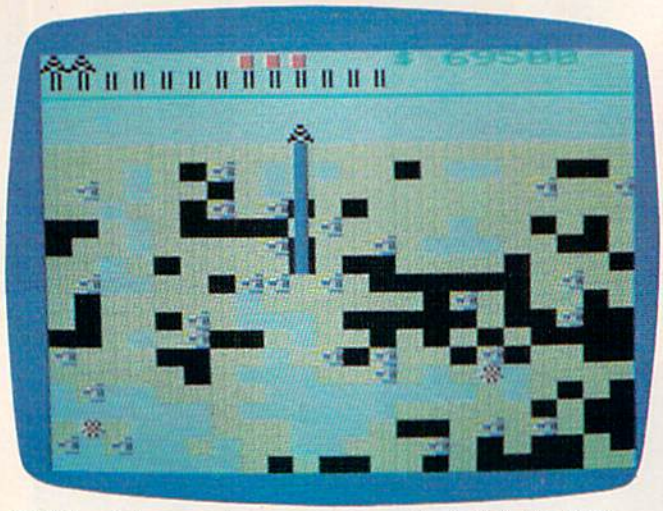

Drilling into an underground reservoir of oil in the VIC version of "Oil Tycoon." Note the little red devils lurking in the pumped-out caverns.

LOADs and RUNs the second program, erasing itself in the process. When this is completed, the message "PRESS STOP ON TAPE" appears at the bottom of the screen and the program waits until you comply.

Because of the Commodore 64's much larger memory, the 64 version is one completely self-contained program.

Difficulty Levels

The next screen displays the high scores attained for each of the eight difficulty levels. The program will return to this screen after each game. Your score and the difficulty level of the game you have just completed are displayed at the top of the screen.

At the bottom of the screen you will see "DIFF. LEVEL 12345678." Choose the difficulty level by moving the joystick left and right and pressing the fire button when the number of the difficulty level you want is blinking. Level one is primarily for small children. I would recommend that seasoned gamers begin with level two. The higher the difficulty level, the more difficult the game becomes. The various conditions for the eight difficulty levels are as follows:

Level	Sticks of Dynamite per Oil Rig	Pieces of Shale	Invisible Shale
1	3	20	No
2	2	20	No
3	3	30	No
4	2	30	No
5	4	20	Yes
6	3	20	Yes
7	4	30	Yes
8	3	30	Yes

Playing Oil Tycoon

After you choose the level, the oil field is drawn on the screen. It will be different for each game; you should never see the same screen twice. For each game, you receive five oil rigs, each of which has 20 lengths of pipe and a number of sticks of dynamite, depending on the difficulty level you choose.

In the upper-left corner of the screen are the oil rigs you have remaining. In the upper-right corner is your score. Between these are the sticks of dynamite you have remaining for the oil rig now in play. The second line displays the unused lengths of pipe for the oil rig now in play. As you drill, this pipe will be used one length at a time and will be replaced as you withdraw your drill. The lower portion of the screen is the playing field. Yellow squares are dirt, black squares are oil, and the irregular squares are shale.

Move the joystick left and right to position your oil rig over the column you want to drill through. To drill, pull the joystick down. To withdraw the drill, push the joystick up. You cannot move the oil rig while there is drilling pipe in the ground. You cannot bore through shale, devils, or off the bottom of the screen. If you try, your drill will be ground up, and you will lose that length of pipe for the oil rig in play. This becomes very important in difficulty levels above four, for the shale is invisible and looks like dirt. At these levels, it is very easy to lose most of your drilling pipe before you realize that you are trying to drill through shale.

Also try to avoid drilling through empty spaces from which you have previously pumped oil. Natural gas can collect in these empty spaces and may cause an explosion when you try to drill through them again.

Controlling the fire button takes some getting used to, because it does three things. As you bore, if the end of the drilling pipe is in oil or an empty space, pressing the fire button causes your oil rig to start pumping. If the end of the pipe is in dirt, pressing fire drops a stick of dynamite down the pipe. If you are not drilling, or if you have fully withdrawn the pipe, pressing fire replaces your current oil rig with one of your remaining rigs. Be careful – it is easy to lose valuable rigs. Replacing your oil rig with a new one is useful mainly when you have used up your allotted dynamite for the rig in play, or if you do not have enough pipe remaining to reach pools of oil near the bottom of the screen.

Use your dynamite to blow up shale, devils, or dirt. Note that when you drop dynamite down the pipe, it will continue to fall until it hits one of these three obstacles. This means that if there is oil or empty space directly below the tip of the drill, the dynamite will fall out of the bottom of the pipe and through this space until it hits shale, a devil, or dirt.

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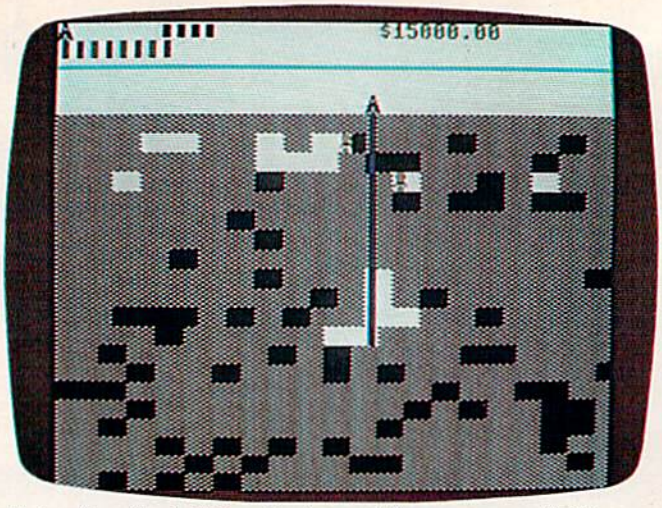

Extending the drilling pipe toward deep reserves of oil in "Oil Tycoon," 64 version.

Pumping Oil

When you pump, all of the oil in adjacent spaces to the sides and above the level of the drill bit will be pumped out. In other words, all squares of oil connected to the one you are pumping will also be pumped out only if they lie directly *above* or *to the sides* of the oil being pumped. Any squares of oil *below* those which are being pumped out will remain where they are.

If you uncover a devil while pumping, it will blow up your oil rig. If you try to pump a pool of oil which is at or below the level of an uncovered devil, and which is directly connected to the devil's space, it will also blow up your rig.

The deeper the oil, the more it is worth when you pump it out. An extra oil rig is awarded for each $100,000 you acquire. In addition, if you pump out all the oil on the screen and then retract your pipe, you will be awarded an extra oil rig and a new screen is drawn.

Entering The Program — VIC Version

REM (REMark) statements were excluded in Program 2 to conserve memory. For those who are interested in studying the routines, a summary is presented at the end of this article.

If you do not want to go through the trouble of typing the entire game into your computer, simply send $3 and a blank tape in a stamped, self-addressed cassette mailer to:

Gordon Wheat
200 S. 7th St.
Denton, MD 21629

To enter the VIC version of Oil Tycoon into your computer, type in Program 1. SAVE the program on tape and VERIFY it. Now remove that tape, without rewinding it, and place a second tape in the cassette. SAVE and VERIFY the program on this tape. As before, do not rewind this tape and do not RUN the first program. Type NEW to erase the first program and type in Program 2.

It is *very important* that all BASIC statements be abbreviated when entering the second program or you will quickly run out of memory. Look in your manual to see how BASIC statements are abbreviated. SAVE and VERIFY this program on both tapes. You should now be ready to play Oil Tycoon.

After LOADing the first program, do not press STOP on the cassette recorder; it will stop by itself. When the first program is RUN, it will LOAD and RUN the second program.

This is the first game program I have written, and I have been programming for only nine months, so any comments or ideas would be welcome.

Special thanks to Rick Capacio for his many hours of testing.

Breakdown of Routines – Program 2 (VIC Version)

Lines	Routine
1-4	Game initialization.
5-23	High score screen, difficulty selection.
24-25	New oil rig.
26-29	Drill.
30-33	Secondary loop.
34-39	Primary loop.
40-45	Withdraw pipe.
46-60	Pump.
61-68	Upper screen update.
69-77	Drop dynamite.
78	Natural gas.
79-81	Exploding pipe and rig.
82	Bell sound.
83-84	Explosion sound.
85-86	Devil.
87-92	Screen setup.
93	Explosion picture.
99	Drilling sound.

See program listings on page 145.

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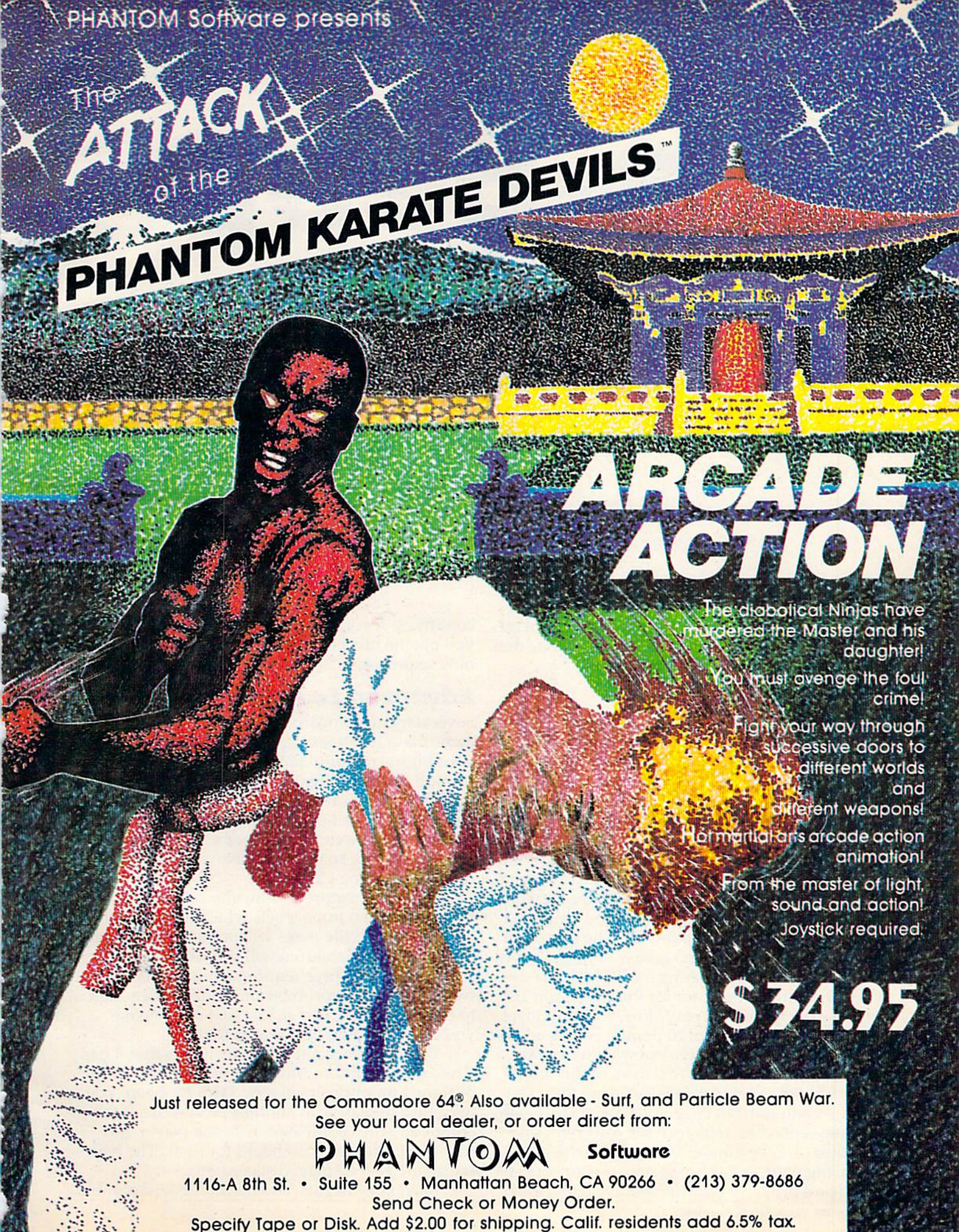
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Re-Beep

For VIC And 64

Robert L. Lykins

"Re-Beep" is a *Simon*-type game written originally for the unexpanded VIC-20. We've added a translation for the Commodore 64.

"Re-Beep" is a game for the VIC-20 and Commodore 64 that will truly keep you on your toes. An increasing amount of concentration is required to keep your score rising. You must duplicate the ever-lengthening tone sequence the computer gives you by pressing the special function keys in the correct order.

If you correctly duplicate the sequence, your score will increase by one. (You receive one point for each beep in the pattern.) The computer will then add a note to the old pattern, and you must then attempt the longer sequence. The computer starts with one note, which is easy enough. Soon, however, you will be hearing a befuddling series of beeps. Can you hold out for the maximum 127 notes the computer can play? Probably not. I feel lucky if I manage to score 20 points. For the memory experts, however, there is a way to increase the note capacity to 255. We'll discuss this later.

When your memory fails, all is not lost. The computer will sound a buzzer, tell you to try again, and then replay the sequence for you. Who says a computer can't be humane? If, despite the trauma of blowing your first try, you regain your concentration and properly play the sequence, the game continues. If you can't do it the second time either, you get the raspberry and the computer starts a new sequence.

Advanced Features

Several features incorporated into this *Simon*-type game make it better than many. First, it remembers your high score until you erase the program or turn off the computer. Some patterns are easier to remember than others, and you may find that you do not score nearly as high on one game as on another. The computer keeps and displays your high score so you will have a goal to shoot for in succeeding games.

A second feature is difficulty selection. You may select from three levels which determine the speed at which the notes will be sounded. Beginners and young children will probably do best on level one. Level three requires a quick wit, so level two is a good compromise. It is not slow enough to become boring, nor so fast that it will make you blink and say, "What was that?"

Perhaps this game's best feature is that it has a two-player option. Most computer games seem designed for only one player. With Re-Beep, you may elect to play with another person. If so, the computer will ask the name of each player and provide a separate scoreboard for each. The high scores are also displayed separately.

Player one begins, and his scoreboard number

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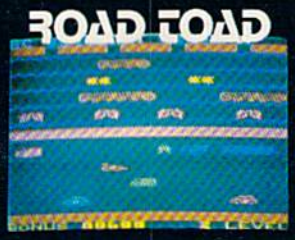


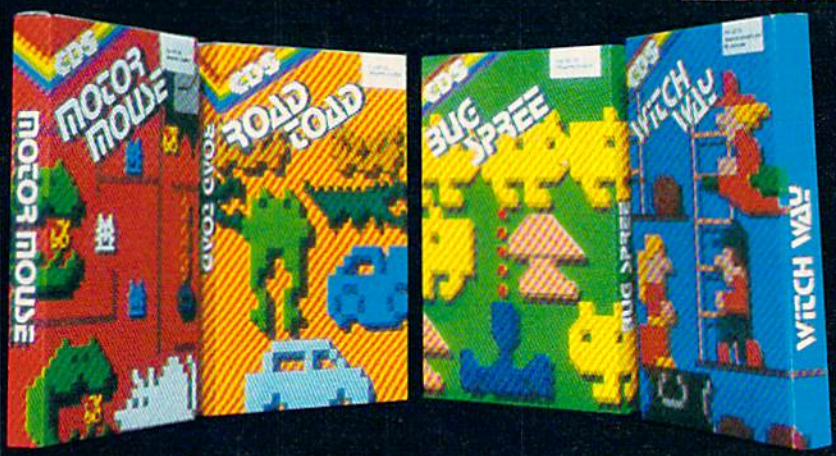
Can our hero make it across the freeway without getting that run-down feeling?

And if he does . . . does he know he can't swim?!?!

It's the thrill of victory and watch out for the alligators!

Keep your eyes open — there's a tasty treasure in cheeses just ahead! But . . . there's hungry cats around every corner!

One wrong move, and you're hickory dickory dead!



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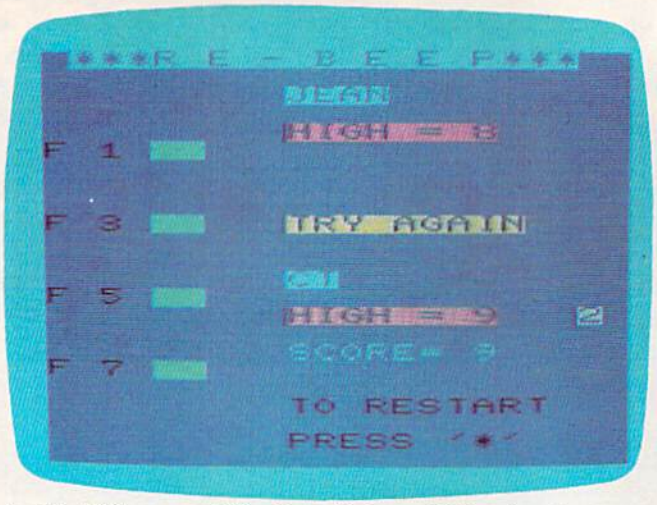
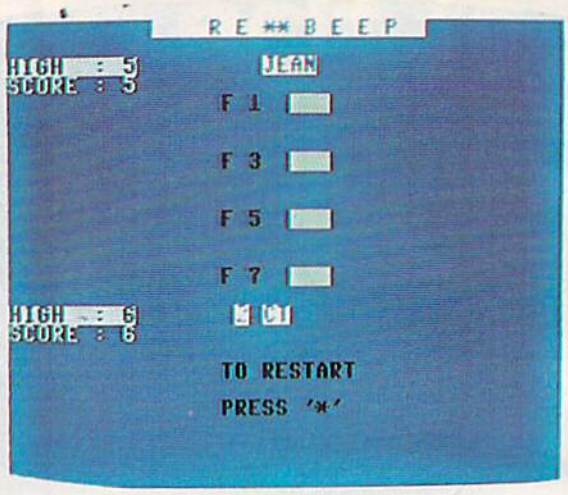


In this VIC game of "Re-Beep," player CT has just been tripped up by a nine-tone pattern – but he gets a second chance.



"Re-Beep" for the Commodore 64 uses the built-in synthesizer to generate tones.

(1) is lit until he loses. The computer then lights the second scoreboard number (2) and begins a new sequence for player two. When player two's concentration fails, play is switched back to player one and his scoreboard. Play thus alternates between the two scoreboards.

If only one person wishes to play, the computer will skip the name request, display only the top scoreboard, and will not light a scoreboard number. This allows maximum concentration on the task at hand.

Opposing teams could be formed if more than two wish to play. Each scoreboard will hold 12 characters for the name or names, but if two are used, they should not be separated by a comma due to the computer's INPUT characteristic of disregarding anything after a comma. A slash (/) should work fine, however.

How It Works – VIC Version

This program employs a technique known as *string concatenation* – the addition of two strings. (A "string" is a group of characters.) In this case, STR$(R) is added to S$, the string containing the information the computer uses to play the series of notes. R is a random number from one to four, inclusive, corresponding to one of the four function keys, and is selected by line 230. It must be converted into a string by STR$(R) so that it can be used in a sequence of numbers.

For example, if S=0, S$="", first R=3, then R=4, then:

Numeric Addition	String Concatenation
S=S+R	S$=S$+STR$(R)
S=0+3=3	S$=""+"3"="3"
S=3+4=7	S$="3"+"4"="34"

In this example, R first corresponds to function key F5 (3), then to F7 (4). Adding three and four numerically results in the number seven, only one numeral which has no corresponding key. But concatenating the strings as in line 240 provides a sequence of selected R values which do have a corresponding function key and tone.

Using lines 260 to 300, the computer plays a series of tones and lights up the green rectangles corresponding to the function keys. It does this by converting each number in S$ into a numeric value (Q) in line 270. Line 290 sends the program to one of four note-playing and rectangle-lighting subroutines, depending on the value of Q. The handy ON-GOSUB statement replaces four IF...THEN statements. If Q=1, the program GOSUBs to the first line number, 480. If Q=2, it GOSUBs to the second, etc.

The NEXT statement in line 300 repeats the process if line 260 indicates there is more (depending on the LENgth of S$). Perhaps you noticed in the string concatenation example that the numerals were preceded by spaces. This is because STR$(R) puts a blank space in front of the numeral, and a LENgth check will bear this out: LEN(STR$(4))=2. Of necessity, then, the FOR-NEXT loop beginning in line 260 starts with 2 and STEPs 2 so that line 270 won't read a blank. If you wish to slow the game, you can start the loop with 1 and eliminate the STEP portion of the statement. This will result in Q having a value of 0 every other time, which will not play a note. Leaving in the STEP portion will result in line 270 reading blanks only, and line 290 will never execute a tone subroutine.

After all the notes in S$ have played, lines 310-350 get the player's response on the function keys, play the appropriate notes with the same subroutines, and build F$. Line 370 compares the LENgth of the player's string (F$) and the computer's string (S$). If they are the same LENgth, it means the player has played as many notes as the computer and further comparisons are made. If not, the program returns to line 310 for more player input.

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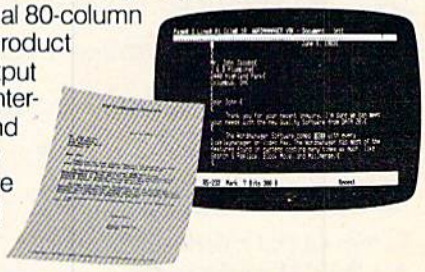

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Line 380 determines whether or not the player's sequence is correct. If not, it allows the player to try again if E=0, then changes the value of E to 1. This causes the program to skip the "Try Again" routine if the player fails the second time.

Line 400 catches this and sends the program to the end-of-game routine. If the program can get by lines 380 and 400 without being diverted, the player has played the sequence correctly, and the program enters the scoring routine. The program then adds another numeral to S$ and the tone sequence lengthens. The process repeats.

For Mnemonists

Allowing STR$ to put blank spaces in S$ and F$ actually wastes half the memory available for the tone sequence, limiting it to 127 notes, though this quantity should prove to be more than adequate for most players. Perhaps a few readers have really extraordinary memory capabilities. If so, the following will increase the challenge of the game. If not, at least it illustrates what can be done to solve the waste problem and may be useful in other applications.

To fill S$ and F$ with useful numbers (and obtain 255-note capacity), only the numeral and not the blank space in STR$ should be added. This is accomplished by using the RIGHT$ function as illustrated in lines 240 and 320-350 below. In this instance, the farthest right character from STR$, the numeral, is added to the tone string instead of the whole of STR$.

Change the following lines for 255 notes:

```
240 S$=S$+RIGHT$(STR$(R),1)
260 FORL=1TOLEN(S$)
320 IF Z$="{F1}"THENGOSUB480:F$=F$+RIGHT$
    (STR$(1),1)
330 IF Z$="{F3}"THENGOSUB540:F$=F$+RIGHT$
    (STR$(2),1)
340 IF Z$="{F5}"THENGOSUB600:F$=F$+RIGHT$
    (STR$(3),1)
350 IF Z$="{F7}"THENGOSUB660:F$=F$+RIGHT$
    (STR$(4),1)
```

Other Techniques

Level of play is determined by the value of LV (1-3), INPUT early in the program (line 50). Certain lines in the program employ delay loops that incorporate LV. LV is squared and is then used to divide the loop length number. On level one, the number is divided by one – no change. If LV=2, the number is divided by four (LV^2), substantially reducing the delay. And on level three, the number is divided by nine.

Loops are also employed to print multiple items on the screen. The title display is created in this manner by line 40. Different print colors are obtained by POKEing 646,L. Lines 150 and 160 print the function keys' F numbers and matching green rectangles. Using this technique can be a memory saver.

Note that line 130 uses a WAIT statement rather than the more familiar 130 GETA$:IF A$="" THEN 130. You should experiment with this before putting it in your own programs, however, because the results are somewhat unpredictable. (See "Hints and Tips" in this issue.) Memory location 197 contains keyboard information. Using WAIT 197,64 will cause the program to wait until any key is pressed, including the RETURN key, which may still be down from INPUTing in line 60 or line 80. This problem is solved by using number 32 instead of 64. Now, about half the keys will cause the program to continue, including the space bar. The RETURN key will have no effect. Using another number may cut out more keys or may be ineffective in stopping the program at all.

You may have noticed that some PRINT statements do not have ending quotation marks. They are unnecessary on the VIC and 64 at the end of a line, unless used to define the length of a series of blank spaces.

Also unnecessary many times is the REVERSE OFF command. If the PRINT statement is not followed by a semicolon, REVERSE is automatically switched OFF when the statement ends. Line 769 is a REMark, but without the REM. It is unnecessary because the program never reaches this line, and so never detects the syntax error. The lines following it are subroutines, and line 760 sends the program to a line above it. These techniques can also save memory.

Readers who would like a tape copy of this program (VIC version only) may send $5 for a copy returned postpaid or $3 with a blank tape and a self-addressed, stamped mailer to:

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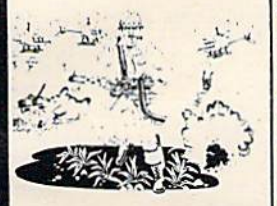

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MOW - Get ready for the fast and furious action of the craziest mower you have ever seen. How much grass can you cut? Joystick moves your mower around as fast as you dare. Watch out for granny's dafodils and grandpa's radio antenna. **$14.95**

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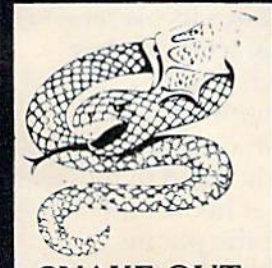
TARGET COMMAND - The whole West Coast is being bombarded and only you can save it. You are at the controls of the missile launcher and hold the destiny of our country in your hands. It takes a cool head, not hand and fast reflexes to zap those missiles right out of the air. Get ready to pulverize — atomize and vaporize them. Oh, my God, those warheads are heading right for our ammo dumps. They are everywhere. NO ONE CAN SAVE US — EXCEPT YOU. You must move your laser into position and fire as fast as you dare. Time limit with arcade style excitement. Protect your ammo at all costs. 10 levels of play. **$14.95**



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SNAKEOUT - Slip your snake into position and score by chomping the blocks. Watch the way you slither because your escape routes get smaller. 2 Bonus games included. **$14.95**

HEAD-ON - Please do not buy this game if you are the type that says "I'll play it just one more time". Players have been known to start playing HEAD ON at 8:30 p.m. and at 2 a.m., wonder where the time went? Have you ever tried to explain to someone why you played a game for five and a half hours. We know of no remedy for the addiction to HEAD ON except to beat the VIC on level 9. No one has done it, YET, will you? We think not. Move your car as fast as you can dare around the tracks. You get 3 cars and MUST avoid the computer car. Points for the most dots covered. Bonus cars, nine levels of play. **$14.95**

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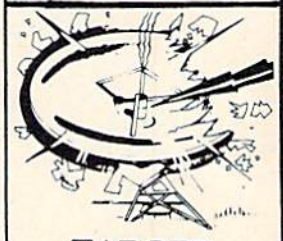

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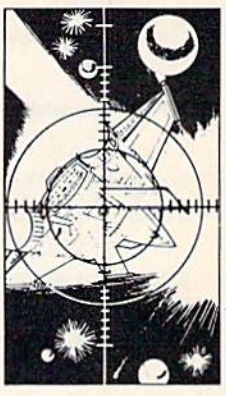

SPACE PAK

HEAD ON

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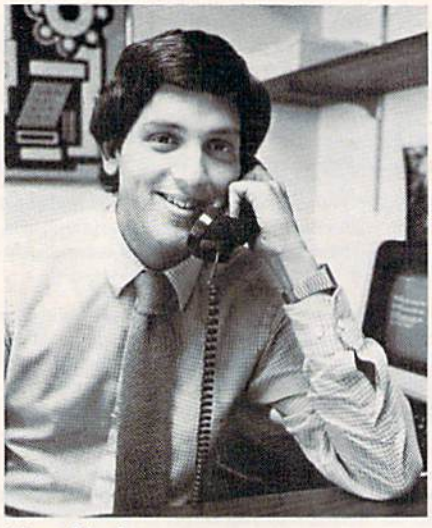
Marc Blank
The Programmer Behind *Zork*

Kathy Yakal, Editorial Assistant

Don't call Infocom a "software publisher." Or its creative staff "game programmers." This month's "Inside View" looks at the rather unusual evolution of a staff of game designers and the unique products they are creating.



Marc Blank.

Take a look at any software best-seller list. Chances are you will see a great number of games that involve gobbling up little dots, or shooting at something that's trying to annihilate you, or working your way through mazes.

There is another kind of computer game that has developed quite a following over the last few years: the adventure game. "We're the only people committed to that sort of game," says Marc Blank, 28, vice-president of Infocom and the programmer behind *Zork*. "I'm happy to be doing something that no one else is doing."

To date, Infocom has seven products on the market: *Zork I, II,* and *III, Starcross, Deadline, Suspended* and *Witness*. All adventure games. And all successful. "Our adventures are more like books than games." says Blank. "They are a valid form or entertainment, a new kind of fiction."

Early Inspiration

Blank's personal interest in adventure games goes back to when he was an undergraduate at the Massachusetts Institute of Technology in the mid-1970s. He, along with people all over the country, played the original *Adventure* (written by Don Woods and Willie Crowther, who were then at Stanford) on huge mainframe computers. *Adventure* required a tremendous amount of memory – about one megabyte.

This original adventure game was based loosely on the Dungeons and Dragons theme – a fantasy that requires its players to take on the personas of other characters as they engage in an imaginary trek through a castle, seeking treasure and warding off monsters.

The major interaction in this large-scale fantasy game was two-word commands typed in by the players on their own terminals at home and transmitted through a modem over the phone lines. The computer played the role of the dungeon master; it knew where all the treasure was

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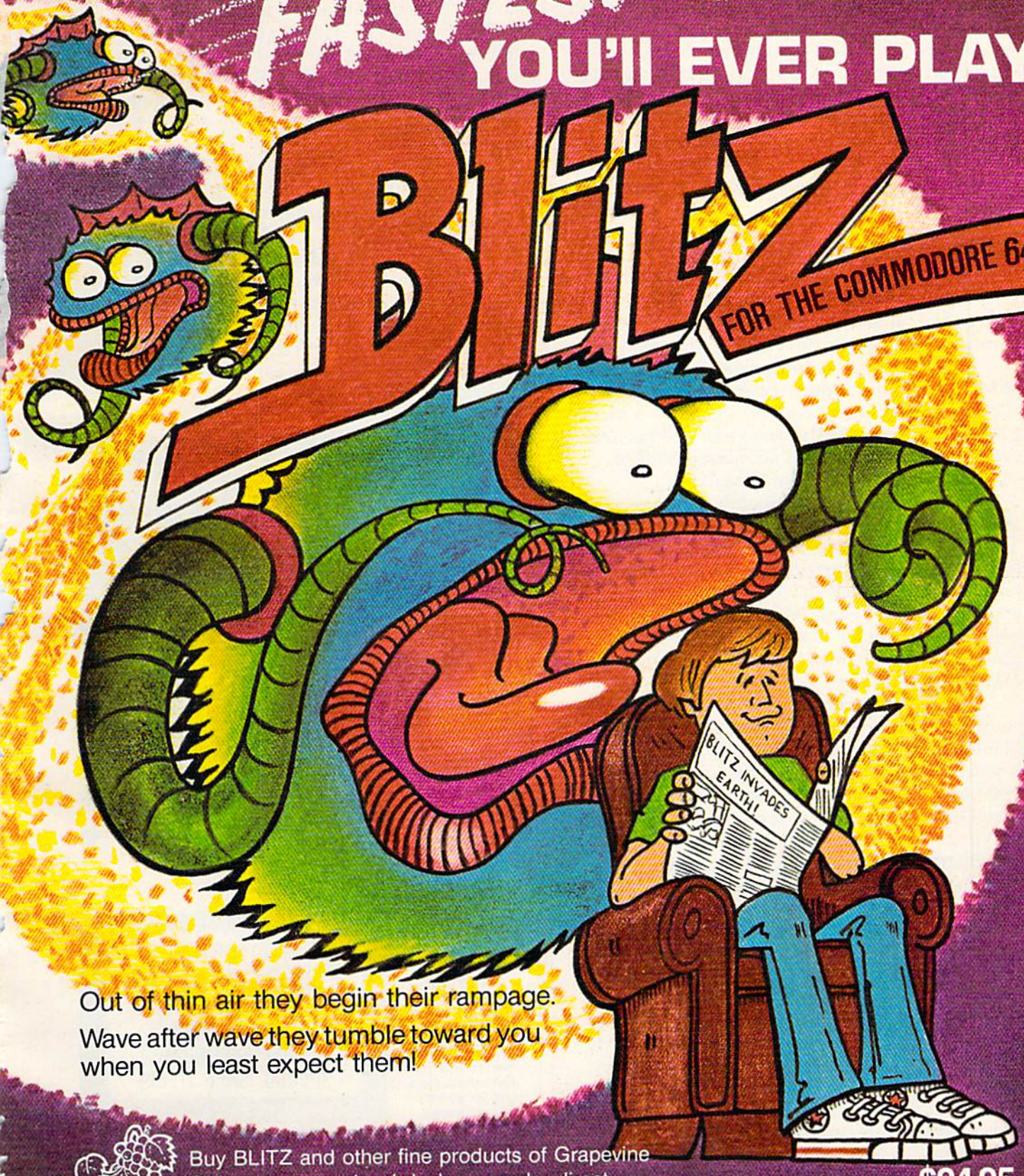

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hidden and all the danger lurked, and would execute the players' commands and tell them the results of their actions.

One of the problems with this initial version, according to Blank, was the computer's lack of vocabulary. Because it would accept only two-word commands, the computer made some decisions that would have made the game more challenging had they been left up to the player. For example, you could enter the command, "Open door," and if there was more than one door near you, the computer would decide which one you meant.

The Birth Of *Zork*

Marc Blank believes that one of the motivations for programming is to see if you can do something better than what's already been done. So he started to work on an adventure game of his own.

Using MDL, a computer language invented at MIT, Blank and some of his acquaintances wrote the original version of *Zork* on a PDP-10 (a mainframe). Blank had by this time finished his undergraduate studies and was attending medical school at Albert Einstein in New York.

The mainframe version of *Zork* first became available in June 1977.

Blank graduated from medical school in 1979 but decided not to pursue that profession, opting for what he considered a more creative field. He and a few other people spent the next year developing a language that they could use to program adventure games like *Zork* on the new microcomputers.

Memory limitations of micros forced them to cut the original version of *Zork* in half. But, says Blank, the new game was actually more complex. It took up about 70K (which does not mean that you need a computer with that much memory to play *Zork*; the program is set up so it calls on different sections at different times).

Blank believes an important element of adventure games is making the players feel like there's no computer there – that they're actually participating in the fantasy. One of the ways this was accomplished was by developing an English language parser that would allow the computer to respond to more than two-word commands.

"An adventure game is only as good as its parser, that part of the program through which the player communicates with the game's environment," says Blank. "If the parser gets in the way of the player's creative expression, even the best-plotted game can become slow, tedious, and frustrating."

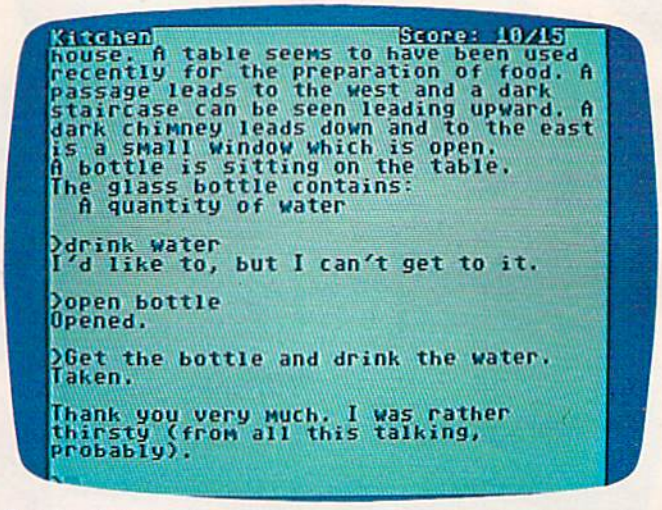
The original *Zork*, programmed for the Apple and the Radio Shack TRS-80, had a 600-word vocabulary, which helped accomplish Blank's goal of communicating with the game itself. Later Infocom adventures have even larger vocabularies.

Providing An Alternative

In a market as volatile as the microcomputer software industry, it's highly unusual for one publisher to dominate the best-seller lists. Infocom has managed to do that. In its four years of existence, the company that Marc Blank helped create has yet to produce an unsuccessful product. Why?

"They're good. Very entertaining," says Blank. "After all, the classics stay in print, don't they? Besides, peoples' imaginations don't go out of style."

Blank doesn't see adventure games as a replacement for arcade games – merely an alternative. "I like arcade games as well as anyone, but a computer can handle much more than games," says Blank. "People like to see themselves as characters in a story. We're committed to giving them those stories."



Pausing for refreshments in a game of Zork *on the Commodore 64. Note the program's amusing response to the compound sentence "Get the bottle and drink the water."*

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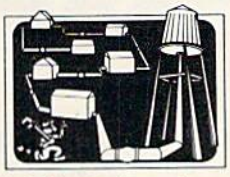

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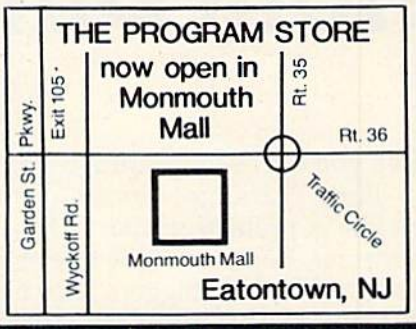

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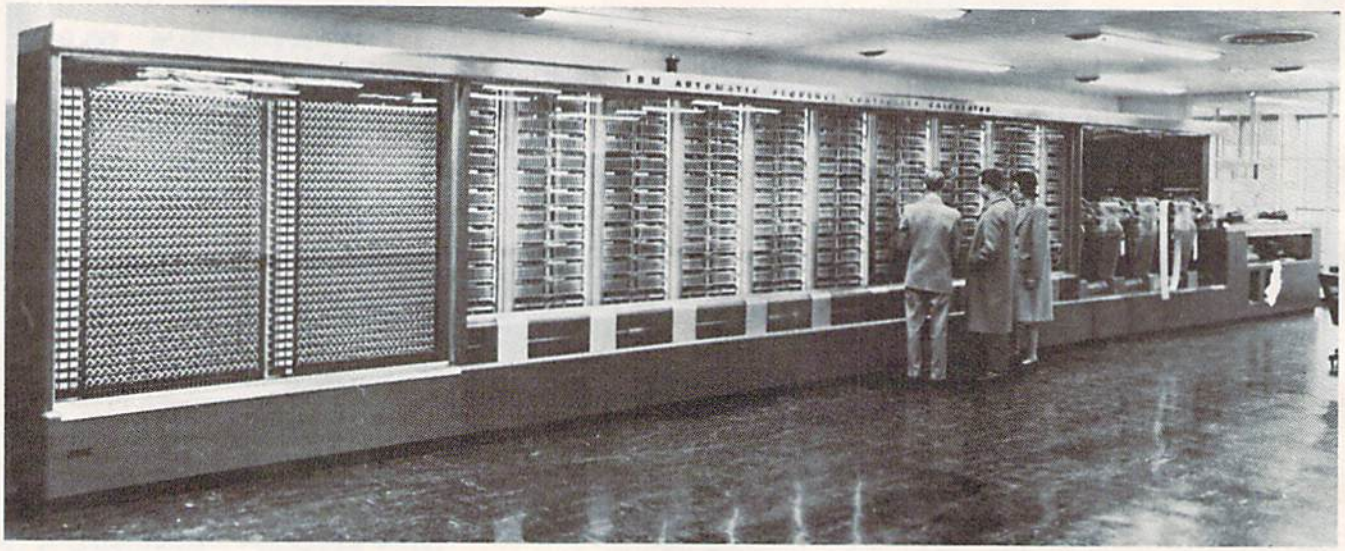

A "dinosaur" computer of the 1940s. When the IBM Mark I began working in 1944, it sounded like a roomful of knitters using metal needles. It went "clickety-clickety-clickety."

Courtesy of IBM.

From Dinosaurs To Freckles

Have you ever seen a dinosaur spit out numbers?

Forty years ago, dinosaurs inhabited Earth, just like in prehistoric times. The dinosaurs were enormous. Some were the size of your living room. Others were even bigger. They filled warehouses, laboratories, and entire city blocks. And when they were well fed, they spit out numbers.

The dinosaurs had metal skin. Inside their bodies were millions of wires, some the size of jungle pythons. The dinosaurs were controlled by thousands of hot, glowing vacuum tubes the size of big dill pickles. The vacuum tubes acted like traffic cops and routed the flow of electricity through the dinosaurs' wires.

The dinosaurs spit out numbers. They also ate them. The dinosaurs liked only two kinds of numbers: ones and zeros. Dozens of human beings fed them ones and zeros in long, caterpillar-like strings.

The humans hoped that after the dinosaurs finished eating, they would say something wise. They hoped the dinosaurs would solve their problems. But the dinosaurs were slow. After weeks of eating bucket loads of numbers, the dinosaurs finally answered. Unfortunately, they were often wrong.

In some ways, these recent dinosaurs were unlike their ancestors. For example, the old prehistoric dinosaurs were mostly brawn. They had tiny brains, the size of a pea or a walnut. Like the old dinosaurs, the new dinosaurs were big. But their bigness was all brain.

The new dinosaurs were different in another way, too. The first dinosaurs were living creatures. They were *reptiles*. Their descendants include alligators, crocodiles, snakes, and lizards. These creatures are alive today.

But the new dinosaurs were not alive. They weren't even creatures at all. They were machines. They were the world's first *computers*!

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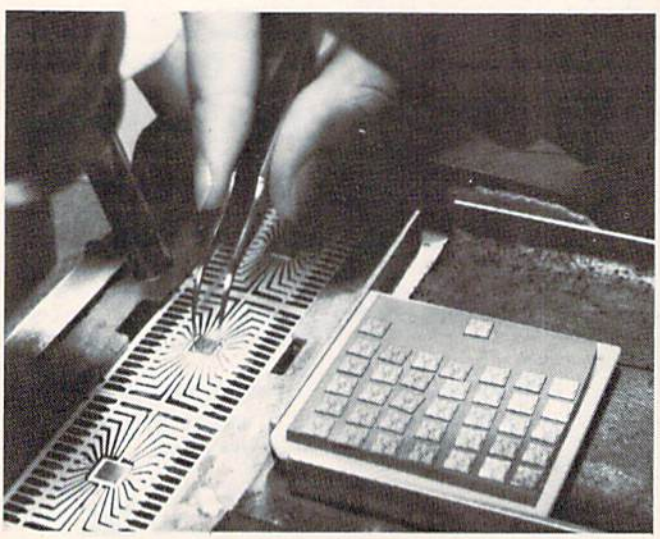
Engineer Mike Grieco at Bell Labs holds a wafer with 64 tiny chips. Behind him you can see a TV picture of the transistors on just one chip magnified 400 times.

Courtesy of Bell Laboratories.

The computers were almost as rare as dinosaurs. For several years after they were invented, there were only half a dozen computers scattered across the whole world. And, though they were big, they were sensitive and fussy creatures. Every time you turned them on, one or two of their vacuum tubes would explode from the surge of electrical power. Then it sometimes took people several days to find the bad tubes among the thousands of good ones.

Almost as soon as computers were invented, scientists, business people, and military generals realized that computers, one day, could become important machines. Computers could help people conduct experiments, solve mathematical problems, process a company's records, and guide missiles, satellites, and spaceships. But, somehow, they had to become smaller, faster, cheaper, and more reliable.



"Brain" chips are lined up like soldiers on parade. A human factory worker uses tweezers to pick up the chips and place them in a protective metal package. The packages resemble spiders with 28 gold legs, so they are known as "bugs."

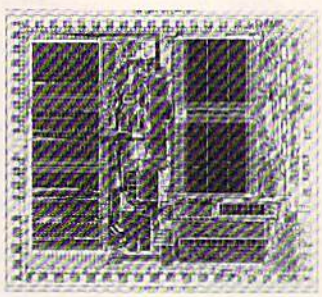
Courtesy of Texas Instructions Inc.

No More Tubes

Then a breakthrough occurred. Two days before Christmas in 1947, scientists at Bell Laboratories in New Jersey invented the *transistor*. Transistors could function just like a computer's vacuum tubes. They could act like "magnifying glasses" and create a big electrical charge from a small charge. They could act like "traffic cops" and route charges through a computer's thousands of wires. And they could act like "light switches" and turn charges on and off.

Transistors could do everything vacuum tubes could do. They were also cheaper, smaller, faster, and more reliable.

The first transistors, used in computers in the late 1950s, were about the size of paper clips or small Tootsie Rolls. This was small, but it wasn't small enough. Scientists kept searching for new ways to make the transistors even smaller.



This is what a chip would look like under a microscope. Its thousands of tiny transistors and pathways resemble buildings and streets in a large city.

Courtesy of Motorola Inc.

In the early 1960s, scientists invented the *integrated circuit* (or IC). The integrated circuit could squeeze up to a hundred transistors onto a round surface the size of a small sugar cookie.

To make an IC, scientists grew a large *silicon crystal* in their laboratory. Silicon is an element – one of the basic building blocks of the universe, like oxygen, mercury, and iron. When you go to the beach, you see silicon everywhere, mixed in with the sand. It is the silicon that sparkles up at you when you run across the beach on a sunny day.

The silicon crystals in the scientists' labs resembled long, fat Italian sausages. The scientists sliced the crystals into thin wafers using an extremely sharp buzz saw. They took a photograph of lots of transistors' wires, then reduced (or shrank) the photograph until it was the size of one of the wafers. They placed the photograph on top of the wafer and dropped the wafer in a strong chemical bath. The chemical dug tiny "trenches" across the surface of the wafer. The trenches followed the wires in the photograph. When the chemical evaporated, the trenches were filled with metal. They had become transistors and incredibly tiny pathways for electricity.

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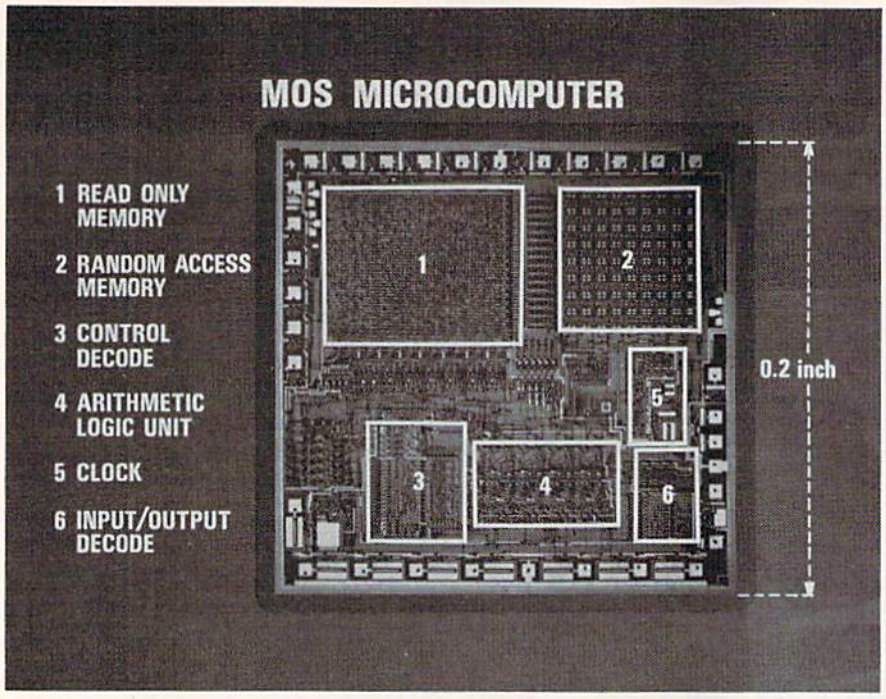

An average chip is only .2 inches (1/5 of an inch) on a side. Yet it is made up of several complicated parts including a part that does arithmetic (#4 – Arithmetic Logic Unit), a "clock" (#5), a "brain" (#3, #4, #5, and #6 working together), and two kinds of memory (#1 and #2).

Courtesy of Texas Instruments Inc.

connect them to typewriters, TV screens, and tape recorders, they become *personal computers*!

Kids use personal computers to draw pictures, make music, do their schoolwork, and play games. Personal computers fit on top of a kitchen table.

Personal computers are small and easy to use. They use less power than a simple light bulb. Yet they are a million times more powerful than the dinosaur-sized computers of forty years ago.

The early computers weighed more than a basketball team of elephants. They were powered by up to 20,000 vacuum tubes and cost millions of dollars.

A personal computer might weigh less than five pounds. It might cost less than $100. And its "brain" is a chip the size of a freckle.

The scientists cut the round silicon wafer into little squares the size of a bread crumb. Each little square was called a *chip*. On its surface were dozens of transistors. The transistors criss-crossed the chip's surface, like a maze of tiny roads.

Computers On A Chip

During the 1960s and 1970s, scientists found ways to pack more and more transistors onto a single chip. Today, in the mid-1980s, scientists are able to build a chip with more than a *million* transistors.

The first chips were primitive. With only a couple of transistors, all they could do was turn lights off and on, or remember a couple of numbers, like 5 and 14.

Today's chips are completely different. They can do almost anything! A single chip can act as a computer "brain" and add a million numbers in only one second. It can act as a computer "memory" and remember a hundred thousand kids' birthdays. It can tell the time, control a car, guide a robot, or act as your opponent in an electronic game.

An entire computer can fit on a single chip. But chip-sized computers are too small and delicate for us to carry around in our pockets. To use them, we must connect them to something larger. We can wear them on our wrists inside digital watches. Or we can hide them inside dishwashers, arcade games, and microwave ovens. Or, if we

Chips are so small they could hide under your tongue, behind your ear, in your sock, or ride on the back of a ladybug.

Courtesy of Intel.

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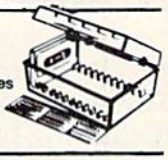

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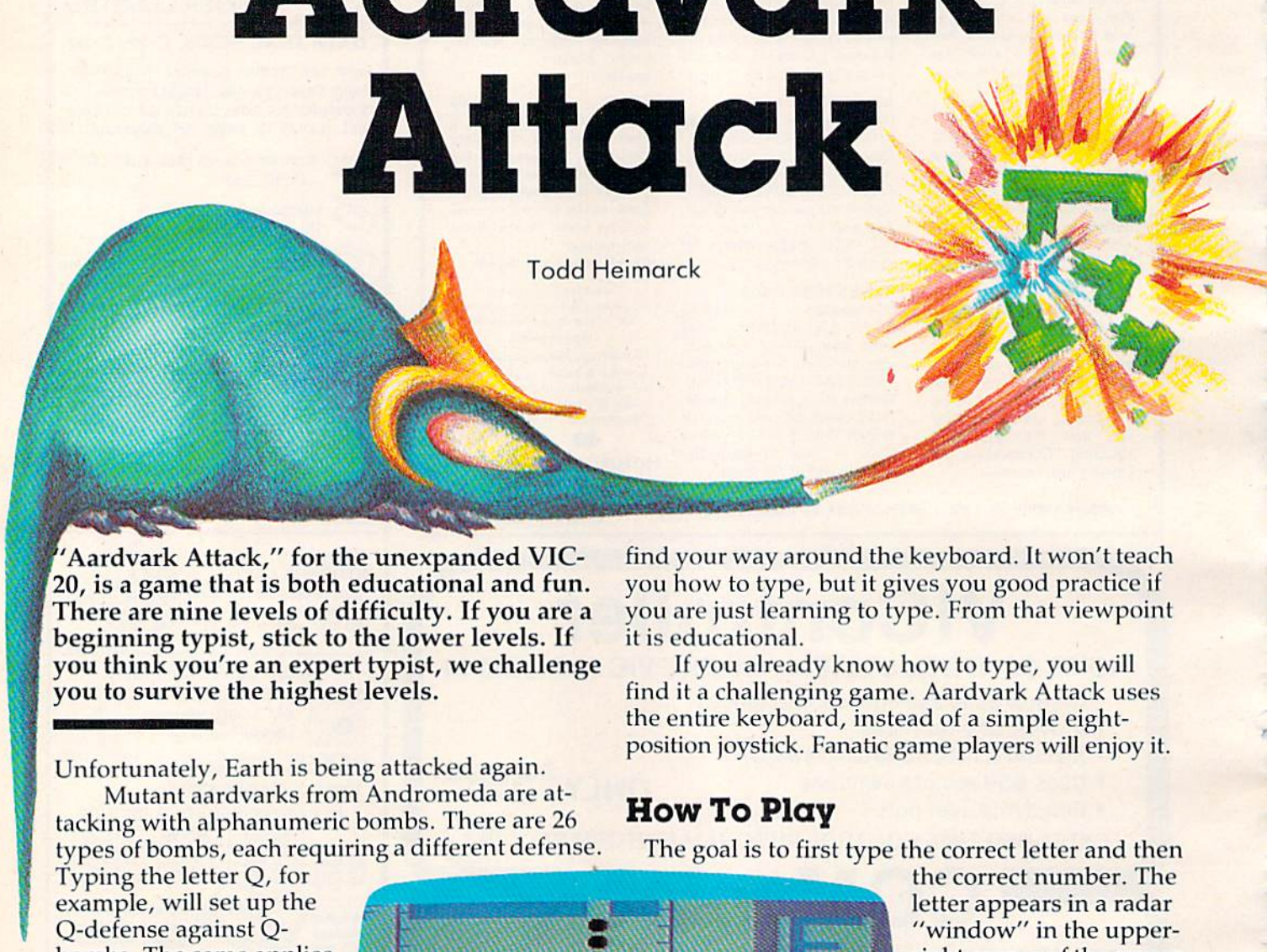
Aardvark Attack

Todd Heimarck



"Aardvark Attack," for the unexpanded VIC-20, is a game that is both educational and fun. There are nine levels of difficulty. If you are a beginning typist, stick to the lower levels. If you think you're an expert typist, we challenge you to survive the highest levels.

Unfortunately, Earth is being attacked again.

Mutant aardvarks from Andromeda are attacking with alphanumeric bombs. There are 26 types of bombs, each requiring a different defense. Typing the letter Q, for example, will set up the Q-defense against Q-bombs. The same applies to the other 25 letters. Also, the aardvarks are attacking your ten biggest cities (numbered 0 to 9). Once you set up the defense, you have to decide which city is being attacked.

Educational And Fun

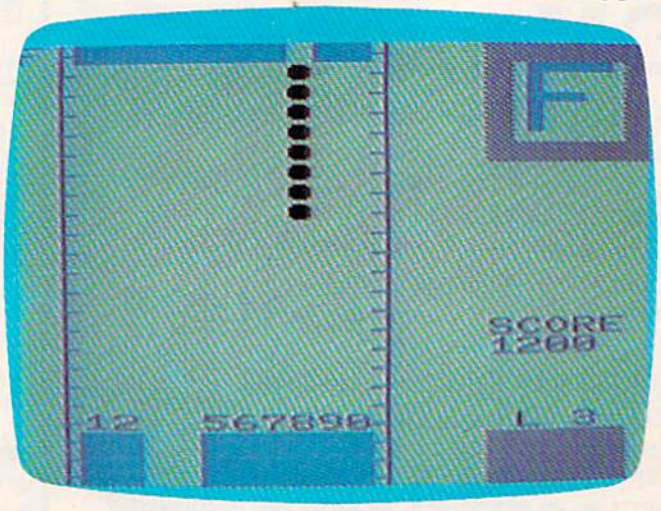
You could say that "Aardvark Attack" helps you find your way around the keyboard. It won't teach you how to type, but it gives you good practice if you are just learning to type. From that viewpoint it is educational.

If you already know how to type, you will find it a challenging game. Aardvark Attack uses the entire keyboard, instead of a simple eight-position joystick. Fanatic game players will enjoy it.

How To Play

The goal is to first type the correct letter and then the correct number. The letter appears in a radar "window" in the upper-right corner of the screen. When it appears, you respond by typing it. If you make a mistake, try again. When you get the right letter, the falling bomb reverses colors. Then you look at the row of numbers at the bottom of the screen – representing your cities – and type the corresponding number to destroy the bomb.

You have a limited time before the bomb hits



An F-bomb plunges toward city No. 8 in "Aardvark Attack."

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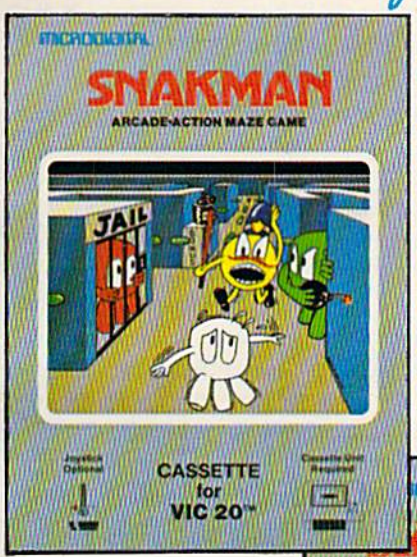

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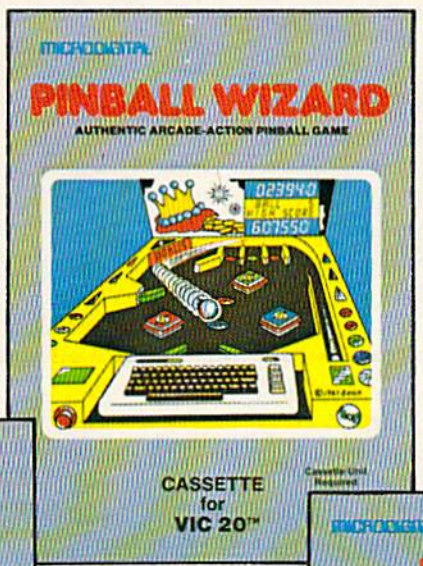

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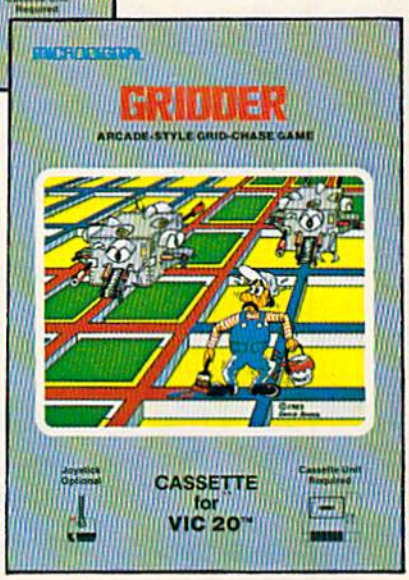

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the ground, ranging from a few jiffies at the expert level to a few thousand jiffies for novices (a "jiffy" is a sixtieth of a second). Each level (there are nine) is about 30 percent faster than the previous one. The faster games score more points, because they're more difficult.

If you are a parent or teacher of very young children who are just learning their letters, you could act as their fingers. Have them call out the name of the letter for you to type. Beginning typists can practice at the lowest levels, while expert typists and game players will like the higher levels. It is a game for almost everyone.

Writing The Game

To be honest, I did not start out to write a game.

I wanted a program that would display larger than normal letters to use as headlines. My first program printed characters that were eight times larger. They were gigantic. But I could fit only four letters on the screen of a VIC-20.

Then I doubled the size of each character. I used custom characters and got the program to work. The only problem was, I had no memory left to do anything useful. It was like having a 20-gallon gas tank and living ten gallons from the nearest service station. By the time you fill the tank and drive home, it's time to go back.

I finally realized the simple solution was to quadruple the size of each character. I left the character generator in Read Only Memory (ROM) and used the graphics characters (the ones you get when you press the Commodore key and type "C" or "V"). The characters were four times as big as regular letters.

Unfortunately, a fourfold increase in size means a fourfold decrease in the number of characters per line. I could print only a five-letter word on each line. I forgot about headlines and used the program as part of a game.

A False Start

Could a single oversized letter be used in a game for beginning typists? Of course! I wrote a simple program that had the endearing quality of boredom. It was not fun to play.

Detour Into Machine Language

Rather than improving the playability of the game, I decided to work on the radar window. As the oversize letter was being calculated, the player could watch it being formed.

I wanted the letter to appear out of nowhere. The old "polar bear in a snowstorm" trick would work. I printed the character white on a white screen (which is impossible to read).

After the character is formed, you change the polar bear into a black bear. Machine language would make it fast. And I believed a friend who said ML was easy.

I did not know how to program in machine language (but it's easy, right?), and I did not have an ML monitor (a utility to make ML programming much easier). I wrote the code, translated to hexadecimal, and translated to decimal. I POKEd the numbers into the cassette buffer (because that's what everyone else does) and started it. But every time I SYSed, I missed. My VIC closed its eyes and ears and played dead. After a dozen tries, I was ready to throttle my friend who said machine language is easy.

I finally figured out that to jump backwards in ML, you have to *exclusive-or* the distance with 255. (If that makes no sense to you, consider your ignorance a blessing.) It worked! And the game was still boring.

Polishing It

My general theory of programming is that if it takes an hour to write a program, it takes ten hours to debug and polish it. Aardvark Attack needed a lot of polishing.

First I added extra columns for the bomb and improved the game graphics. As the complexity of the game increased, it got more interesting. I realized that children would never play a game that was impossible to win, so I added nine levels of play. I tacked on a scoring routine, instructions, and voilà – the game turned out to be interesting and fun to play.

This is how it works, for those who are interested in programming:

Line 10 takes you to the housekeeping subroutine that DIMs the arrays and reads the oversize character shapes.

12 jumps to the subroutine that POKEs the machine language routine into the cassette buffer (SYS 828 clears the window, and SYS 833 turns the polar bear into a black bear).

14-16 give you the instructions if you want them (from subroutine 1200).

18-19 print the title page on the screen.

20-24 set the level of play and the variable HF (How Fast).

25-30 clear the screen and print the playing field. Subroutine 900 clears everything, and 925 clears the field between rounds. Programming hint: If you look at subroutine 900, you will find that it uses the same RETURN as subroutine 925. If you have two subroutines that do almost the same thing, you can put them together to save memory. The machine language program uses the same method.

32 blacks out the radar window.

40-63 pick a letter at random and set up the array that defines the oversize character shape for that letter.

70-74 change the asterisks to solid black spaces

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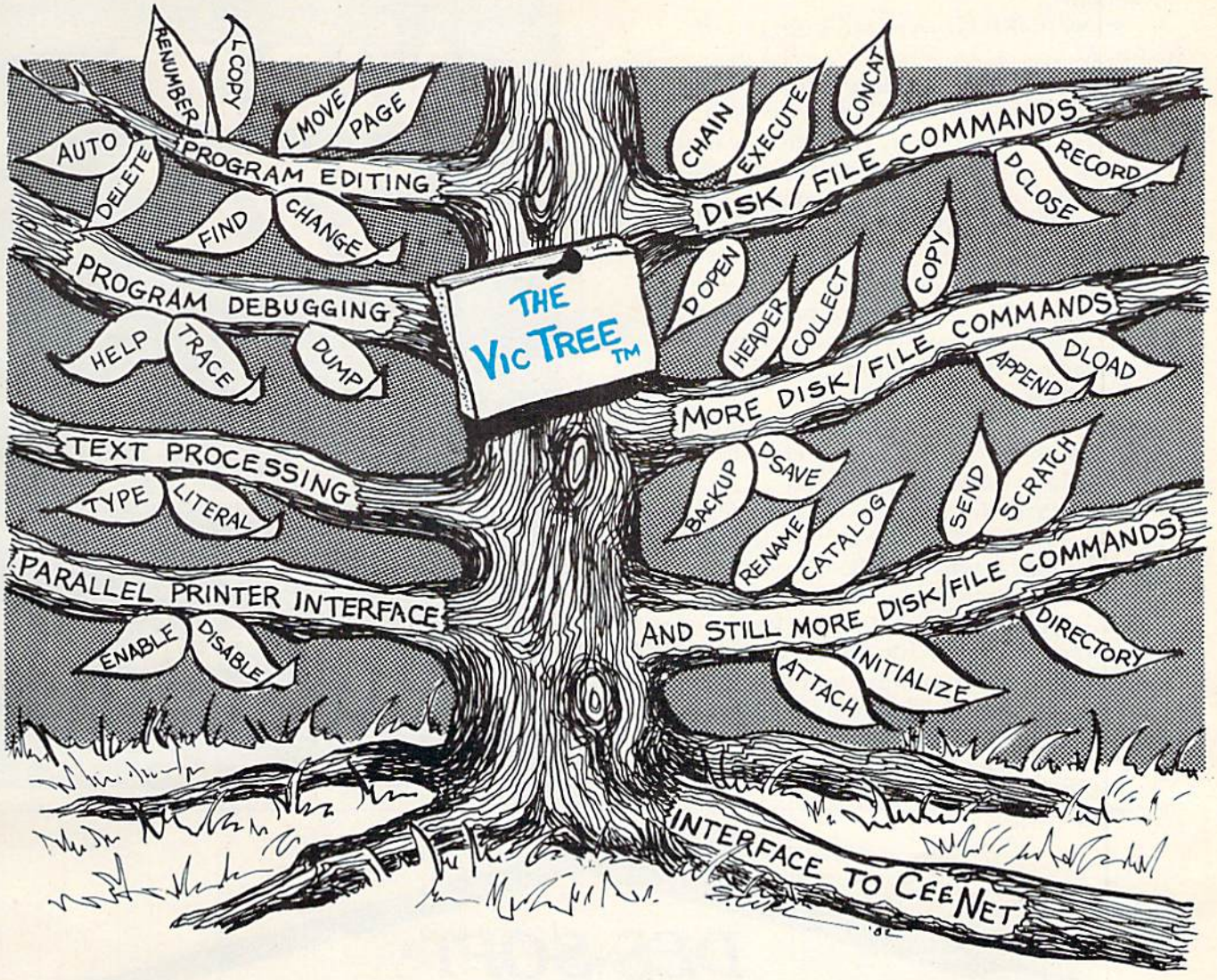

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and flash them (as a warning that attack is imminent).

80-98 POKE the oversize letter into the window.

100-200 are the attack routine. The ball character drops 18 spaces from top to bottom. After each step, there is a delay loop (from variable HF: How Fast). The program also checks for keyboard input. If the right letter and number are typed, it jumps to the scoring routine.

210-280 execute if the bomb drops to the planet. If the letter was correct, one space is erased. If neither letter nor number was typed, two spaces are erased. When defenses are destroyed and an alphanumeric bomb lands, everything is over.

300 figures out the score (if the player typed the correct letter and number) and goes back to clear the field for the next round.

320-328 are for the end of the game, when the planet has been lost. You have the option of playing again at whatever level you choose.

Note: If you use abbreviated BASIC commands, you should be left with a few hundred extra bytes of memory on an unexpanded VIC. You could use this memory for explosion noises or music. Or could add a high score counter (if your household is competitive).

See program listing on page 150.

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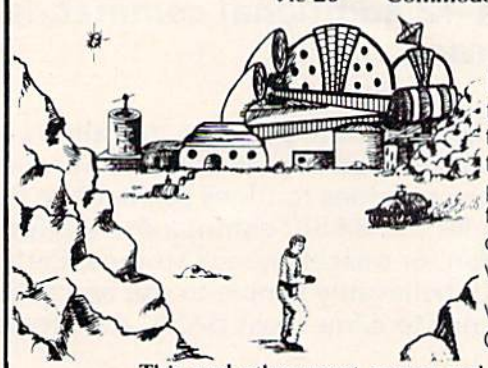
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Listing Legibility: Since many printers do not support the codes/graphics that the VIC-20 and Commodore 64 produce, program listing can become illegible if not impossible (Printer may "hang-up"). The CPI provides three listing modes to address this problem — Normal, Extended Tag and Abbreviated Tag.

In the Normal mode the CPI passes all commands from the computer to the printer. The Normal code would be used for programs written by the user or programs with commands supported by the printer.

In the Extended Tag mode the CPI will generate "tags" (neumonics) for graphics, cursor control, print control and special characters. For any graphics characters that are not standard ASCII, the decimal value of the graphics symbol is printed. For instance, the "checker board" character (press the Commodore key and the plus sign) lists as [166].

The Abbreviated Tag mode is the same as Extended Tag mode, except all the tags are replaced by the "#" sign. This mode would be used if you wanted a program listing to be formatted as the original program. That is without the "tags" using several print spaces instead of one print space.

The CPI is equipped with a built-in self-test program that will check the RAM, ROM and I/O hardware of its microprocessor. This test can be helpful in determining if something is faulty or if the configuration you are using is valid. The self-test will print information to the printer.

CPI LISTING LEGIBILITY TAGS

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[CU]	Cursor Up	[BLK]	Change to Black	[BRN]	Change to Brown	[F3]	Function Key 3
[CL]	Cursor Left	[WHT]	Change to White	[LTR]	Change to Light Red	[F4]	Function Key 4
[CR]	Cursor Right	[RED]	Change to Red	[GY1]	Change to Grey 1	[F5]	Function Key 5
[HC]	Home Cursor	[CYN]	Change to Cyan	[GY2]	Change to Grey 2	[F6]	Function Key 6
[CS]	Clear Screen	[PUR]	Change to Purple	[LTG]	Change to Light Green	[F7]	Function Key 7
[RV]	Reverse On	[GRN]	Change to Green	[LTB]	Change to Light Blue	[F8]	Function Key 8
[RO]	Reverse Off	[BLU]	Change to Blue	[GY3]	Change to Gray 3	[PI]	Pi Symbol
[IN]	Insert	[YEL]	Change to Yellow	[F1]	Function Key 1		

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Word Match

A Memory Game For VIC And 64

Andy VanDuyne

"Word Match," an educational game for one or two players, originally was written for the unexpanded VIC-20. A translated version has been added for the Commodore 64.

Loosely adapted from the old TV show *Concentration*, "Word Match" is designed to entertain and test the memory of one or two players. The object is to find and match pairs of words hidden behind rows of colored blocks.

Word Match is easy to learn. Players take turns selecting blocks, which disappear to reveal the words they conceal. An unsuccessful match means it's the next player's turn. Players who successfully match a pair of words gain another turn, and the matched blocks turn into the player's own color. To win the game, a player must match more pairs of hidden words than the opponent. The opponent, by the way, can be either another person or the computer itself.

Word Match is ideal for grade-school children because all the words are only three letters long. A total of 28 words are included in the program data. (Longer words will not fit on the VIC's screen, although the Commodore 64's 40-column screen format will allow longer words.)

You can customize the program with your own word list by amending lines 32 and 33 (VIC version). Twenty-eight words seem to be the safe limit. If you vary from 28, you must change all occurrences of the number 28 in lines 30, 35, 36, and 38 (VIC version) to however many words you use. The standard words were chosen especially for children at early reading levels.

Using Word Match

When you first run Word Match, it asks for the players' names. After the second name is entered, the screen clears, and nothing seems to happen for a few moments. Don't be alarmed – the program requires some time to select the words and display the screen.

Although Word Match was designed primarily for two players, one person can compete against the computer by typing "VIC" as a player's name when the program starts (or "64" with the Commodore 64 version). The computer, however, is not as smart as you might think. It picks its blocks completely at random. A young child can have fun in this mode without becoming discouraged by an unbeatable opponent.

An interesting twist, incidentally, is to enter the computer's name for both players and then watch the machine play itself. Usually an out-of-memory error results after several rounds, but sometimes the computer actually beats itself!

No delete function is allowed during answer

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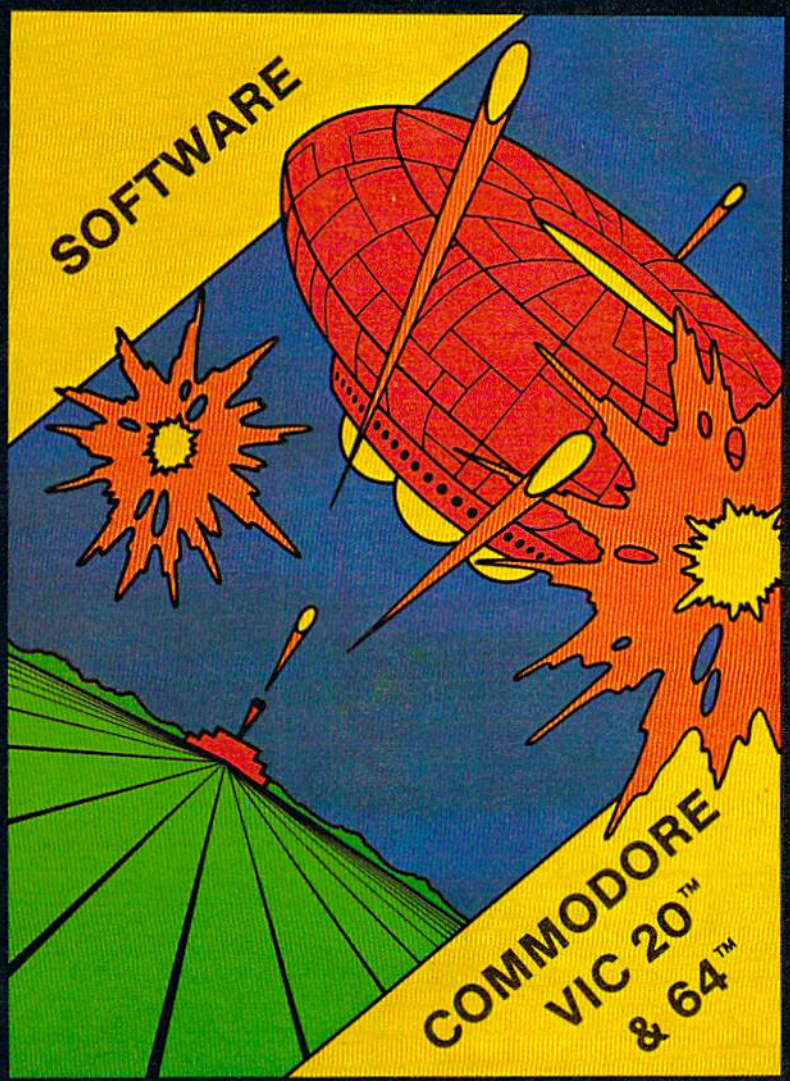

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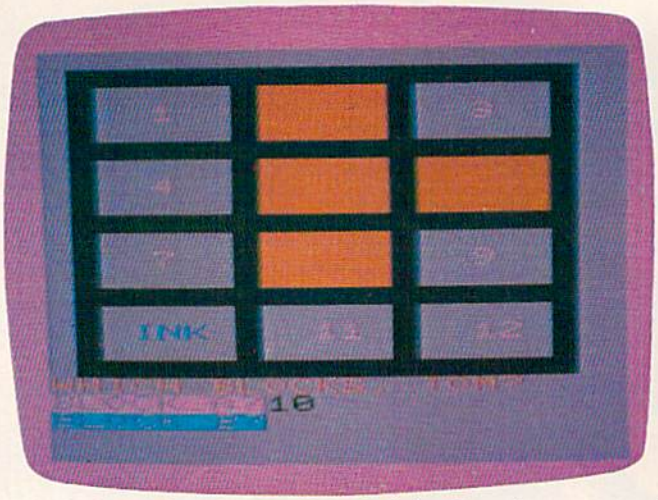

In this round of VIC "Word Match," the player has uncovered the word INK under block 10. Now he must remember which block is hiding the matching INK.

input. However, the program will not accept an answer larger than 12. If you make a typo when answering a prompt, just add an extra digit or two so the response is too large. Also, the program will not accept numbers for blocks which have already been matched.

If you don't feel like typing the program, I'll make a copy for you. Send a blank cassette, a stamped self-addressed mailer, and $3 to:

Andy VanDuyne
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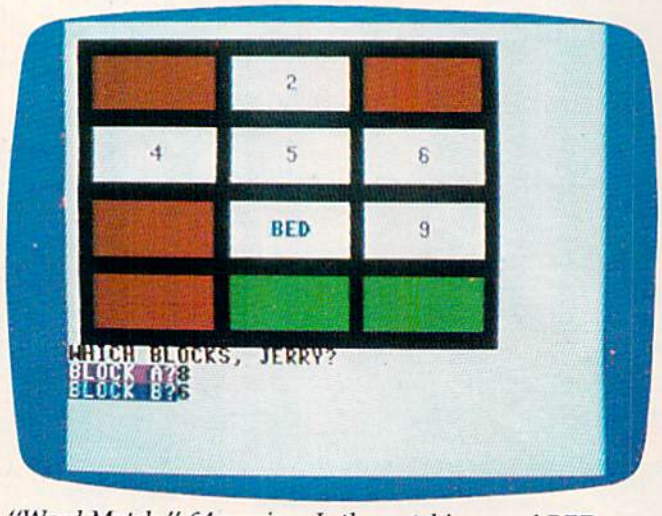

"Word Match," 64 version. Is the matching word BED under block 6, as Jerry thinks?

Notes For Programmers

Here's a brief summary of how the VIC version of Word Match works:

Lines	Explanation
1-13	Start the program and secure the names of the players.
30	Dimension several arrays.
32-33	Store the words.
35-47	Pick and sort six words.
50-81	Set up the screen and store values to find each block later.
100-130	Get the answers.
132-140	Reveal the hidden words.
150-162	Give the response for no match.
200-238	Give the response for a correct match, set aside already matched blocks, and check to see if all matches have been made.
300-314	Declare the game over, who won, and ask about another game.
1000	Is the routine allowing the computer to play.

See program listings on page 151.

Young People

COMPUTE!'s Gazette wants to know what today's young people are doing with computers. We want our readers to know, too. If you've written an interesting program for the VIC-20 or Commodore 64, share it with us.

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for grownups

Giants And Dwarfs

This installment of "Computing For Grownups," a bi-monthly column, looks at the different ways adults and children perceive computers. We also look at one family's approach to word processing.

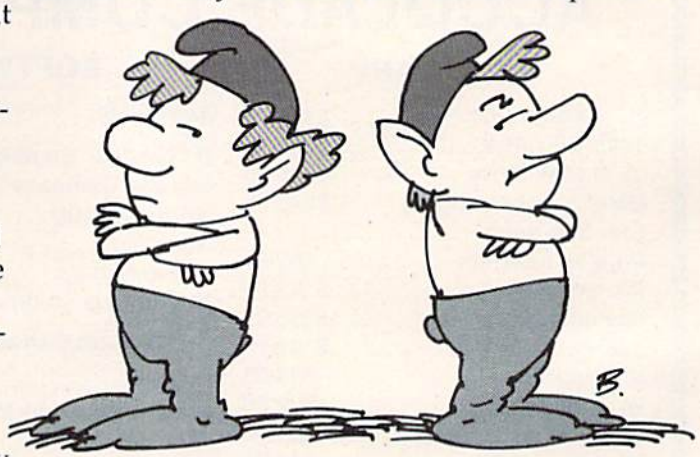
Yesterday my seven-year-old daughter Catie went off to computer camp at Hollins College, here in Roanoke, Virginia. When she came home she could hardly wait to tell me about her day. "Computer camp was fun!" she exclaimed. "I thought we'd have to program all day, but we didn't. We did *lots* of things!"

One thing Catie did was send electronic mail back and forth to her campmate, Ashley Bell. The girls used the Minerva terminals on Hollins College's DEC (Digital Equipment Corporation) computer system.

Using a *big* computer was a new experience for Catie. The only kind of computers she has ever seen are personal computers. Until yesterday she didn't even know what a big computer was. She thought it was really neat that she and her campmates were all using a computer – the same computer! She has grown up in a world of truly personal computing; *group* computing was a new experience for her. And she loved it.

For example, last night she wanted us to wire all our little computers together. Catie wanted to send games and electronic mail from her bedroom to her brother Eric's bedroom, and from the kids' bedrooms to my study, to the kitchen, the basement (kid's playroom), and even to the bathroom ("In case I want to tell you something while I'm taking a bath," Catie said).

I had to explain to Catie that the computers she was using at computer camp were really just terminals – "octopus arms" to a single giant computer. The computers in our house, I said, were different. They were like little dwarf computers –



dwarfs of every sort, color, and personality. The dwarfs were all different from each other. Most were not even on speaking terms. Getting them to talk to each other was not "just a quick project" as Catie called it.

Different Perceptions

All this talk about giants and dwarfs got me thinking. When it comes to computers, Catie and Eric's generation sees things just the opposite of my generation (adults in their 20s and 30s, and above). When I close my eyes and try to picture

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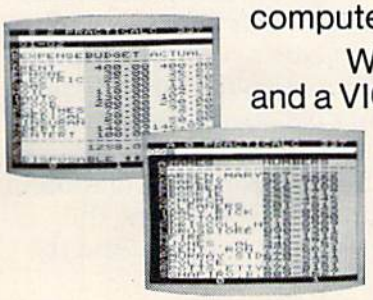

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computers, I still see the big IBMs, Univacs, Honeywells, Burroughs, and other machines. When Catie closes her eyes, she sees VICs, Commodore 64s, Apples, Ataris, and small lap computers such as the Epson HX-20 and TI's CC-40.

Now that small computers are popping up everywhere in millions of people's homes, classrooms, and offices, we adults are beginning to change our impressions. More and more, we acknowledge that there are two kinds of computers – giants *and* dwarfs.

But kids still see only one kind of computer. And that's all they'll ever see, until they grow up and try to get a job. Then, *BOOM!*, they'll come face to face with their first computer giant. And they'll be ill-prepared for that experience.

As far as most kids know, the Computer Age began in 1977 and 1978 with the appearance of the first Apples, Commodore PETs, and Radio Shack TRS-80s. The memories of younger kids don't go back even that far.

For most kids the giant computers have disappeared. Or, they never existed. Giant computers are creatures from adult fairy tales that filter home from the office or workplace. Little kids see them occasionally on TV or in the movies because they are stereotypes. But they are vague, hazy creatures. Based on movies like *Superman III* and *War Games*, kids' images of big computers are certain to be extremely stilted and unrealistic.

Giant computers are not a tangible part of a child's everyday world. But they have not disappeared. They have faded from the popular consciousness because they are not as trendy, fun, or cheap as the little personal computers. And they are not poking their terminals into all of our homes.

Giant computers are not mass-media superstars. But they still run the world. Personal computers are the front men for the computer revolution, but the big mainframe computers are still there, locked in the back room, chugging away, churning out most of the world's work.

An Emerging Network

Pretty soon, mainframe computers will play a larger part in the life of our families. When we dial up an information network such as CompuServe or The Source, we are linking our personal computer with a mainframe computer. Information networks, libraries, mail systems, banks, and shopping catalogs will soon become a major adjunct to "personal computing."

In the next couple of years, small computers will cease to be little isolated atoms in the electronic universe. Instead they will become *nodes* linked in neighborhood, professional, and national networks. Personal computers are now autistic, shut off from each other. This is no way to gather information, learn new things, and get work done. Personal computers must communicate. And the big computers will act as the middlemen.

What's more, big computers have advanced computational abilities still sadly lacking in most smaller computers. As part of their computer education, our kids (even our smallest kids) should learn about these powerful machines.

Computer camps at universities are great places to learn more about large computers. Another place is Walt Disney's EPCOT Center (Experimental Prototype Community of Tomorrow), in northern Florida, near Disney World. When I found out that EPCOT did not feature personal computers in a "community of the future," I called to ask why. An EPCOT official explained that the designers of EPCOT had studied small computers, but they had decided that small computers were still not friendly enough. "Big computers can be much friendlier than small computers," she said. "Our big computers at EPCOT are fast, have gigantic memories to store millions of facts, and are capable of displaying beautiful, high-resolution pictures."

As I listened to her talk, I remembered the big computers I had grown up with. Maybe they were big and fast and were magicians with pictures, but they were also cold, unfriendly, and aloof. As a college student, the closest I ever came to an IBM 370 was when I pressed my nose up against the heavy-duty glass surrounding the computer room. I told this to the EPCOT woman.

She explained that their big computers were hidden away, but their terminals (like the octopus arms of the computer at Catie's computer camp) were all over EPCOT for everyone to use. "And we don't put up a barrier between people and our computers by making people use a keyboard," she said. "People can interact with our computers by operating simple controls, by touching the picture screens, and by talking to them. And the computers talk back."

Family Word Processing

I make my living by writing. I prefer to use *WordStar* on a personal computer to write faster and better. This has made me the default champion of "family word processing" here in our home in Roanoke.

I may be family champion for now, but there are several challengers on the horizon.

First, there is my wife Janet. Janet doesn't like *WordStar*. "It's too complicated," she says. "Using *WordStar*, you don't write a letter, you *program* it!"

Janet isn't an ex-computer programmer like me. Instead of running programs, she runs buses. And when she sits down to type a letter, she doesn't want to program. She does not want to

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go through an elaborate regimen of switch-flipping and button-pushing, as if she were Sally Ride preparing for blast-off on the space shuttle *Challenger*. She just wants to type a letter.

So Janet has abandoned *WordStar* in favor of another word processing program, *Text Wizard*. And now she's turning out whole piles of papers, résumés, and correspondence.

Then there's Catie. Catie does her word processing lying in bed.

Catie's computer is right beside her bed on a card table. Catie has a perfectly good chair to sit in, but she has swiveled her computer around to face the bed, and she types lying down, with her fat black cat draped across her back.

Catie has a simple explanation for the unusual way she has arranged her word processing workstation. "Mowie [the cat] wouldn't fit on the chair," she says.

Catie doesn't use *Text Wizard* or *WordStar*. Her favorite is *Bank Street Writer*. She cranks out page after page of very short stories, and notes to her parents, Eric, and Mowie. According to Catie, *Bank Street Writer* is the preferred word processor for seven-year-old girls, "because it's easy to fill up the little box on the screen, and it makes pretty letters."

(Although *WordStar*, *Text Wizard*, and *Bank Street Writer* will not run on a VIC or 64, many other word processors of similar quality are available. See "A Survey Of Inexpensive Word Processors For VIC And 64" in this issue.)

Gobbledygook Processing

Is that it? Are there any other family members who are challenging me for my position as the family's number-one word processor?

There couldn't be any body else, really. There's Eric and Mowie, but neither of them can read or write.

Mowie is truly out of the running. She's content to lazily nap on Catie's back. But Eric is another story.

Every morning before nursery school and every night right at his bedtime, I find him in the study pounding away on a computer. I'm not certain what Eric is typing, but the paper flies! As far as I can tell, Eric may not even be competing with the other members of the family. He may have created his own category – *gobbledygook processing*.

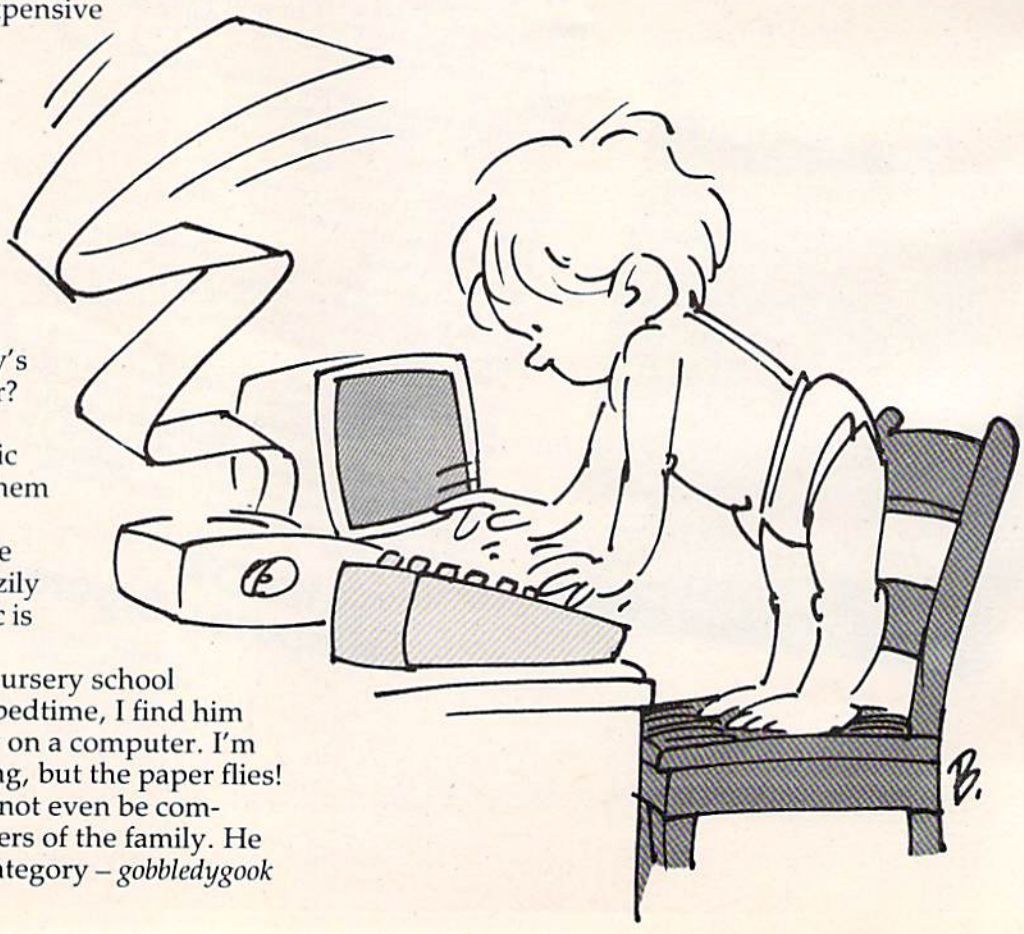
Eric's workstation is even more unusual than Catie's. He achieves maximum productivity when he is standing on the creaky wooden chair in my study and leaning over the computer. He usually does his typing in his bare feet, and this morning, in his underwear, too. (The increased ventilation probably keeps the ideas flowing).

I left him alone this morning for about 15 minutes. When I came back, he had a streamer of printer paper about six feet long sticking out of the computer. "Look at this, Daddy!" he exclaimed proudly. "Look at all the work I did!"

Eric doesn't have his own briefcase yet. So when he went off to school this morning, he had his work rolled up, fastened with a green rubber band, and dangling inside a plastic bag.

As soon as he got to his class, he was besieged by other kids asking to see the bag's mysterious contents. He pulled out the paper, unrolled it, and carefully explained how he made all the hundreds of random letters, numbers, punctuation symbols, and graphic characters that he and the computer processed.

The kids were impressed. They'll probably go home and tell their families. And, who knows, with Eric around, advanced gobbledygook processing might become very popular in Roanoke. Soon all the preschoolers could be doing it.



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Commodore's Public-Domain Programs

John Blackford

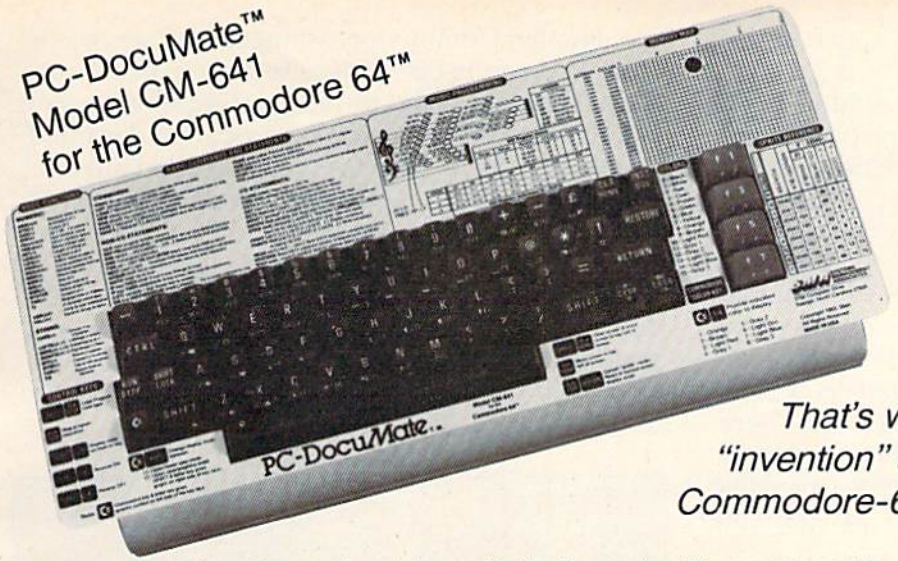
Last spring, Commodore Business Machines released more than 600 educational programs for the PET and Commodore 64 through dealers, who were to make copies for customers at a nominal charge. Now, Commodore has streamlined the offering, putting the best programs on 27 diskettes available nearly at cost. With each disk containing 10 to 20 programs, you can build a software library at rock-bottom prices. The disks are arranged by category (such as math, computer literacy, or business) and may be purchased individually at dealers.

Whenever a new computer appears, a common complaint is that there isn't much software for it. Apple computers were one of the first brands widely purchased by home users, and it took years for software developers to grind out a full line. Now there's plenty of software. The same was true for Atari, except that market pressure speeded up the development process. When the Commodore 64 was introduced, people were impressed with its graphics and sound, as well as the price, but wondered how long they would have to wait for a large selection of programs.

At first, programs were scarce. Commodore's early advertising for the 64 (in the summer of 1982) noted hopefully that the product "will have a broad range of custom software ...." In other words, there was almost nothing yet. But as sales climbed, independents began rushing out games and utilities, and Commodore provided more of its own. By the spring of 1983, software was appearing in some quantity, and Commodore took the opportunity to release a collection of 656 educational programs originally written for the Commodore PET in the Canadian school system.

The idea was to offer the software as a public service at minimal cost. All the programs are in the *public domain* – not copyrighted and free to be reproduced by anyone. They were written for the PET by people in the Canadian schools – and since Commodore is the No. 1 educational computer supplier in Canada, there were lots to choose from. Student programmers there, in cooperation with Commodore of Canada, revised the programs to run on the 64.

Unfortunately, some dealers in the United States were reluctant to handle the material. Under the original plan, dealers were to purchase the complete set – some 50 disks at the time – and make copies available to customers for a small fee. But it looked like a headache to many dealers. Then it turned out that some of the programs wouldn't run properly on improved versions of the 64 (see "Commodore 64 Video Update," COMPUTE!'s Gazette, July 1983). The solution was a simple one-line addition to each program, but



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INCONVENIENT MANUALS

The user's guide was a nuisance and the programmer's reference manual was just plain inconvenient to use. We found the control key combinations confusing and the introduction to BASIC to be too "basic" for our needs. We needed a simple solution to our documentation problems.

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STILL CONFUSED

We found we were confused about music programming, color graphics, and sprites. On both the VIC-20 and the CBM-64 templates we carefully organized and summarized the essential reference data for **music** programming and put it across the top—showing notes and the scale. All those values you must POKE and where to POKE them are listed.

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Dealer inquiries invited.

busy dealers began to wonder how much of their time was going to be involved.

To insure that the programs would be widely distributed, Commodore revised the packaging this summer so dealers wouldn't be tied up with the copying. At the same time, the company went over each program, revising whenever necessary to make sure every one would run on all versions of the 64. Commodore's software team eliminated some programs that were similar to others in the group, and dropped some that weren't of the highest educational quality. The final set consists of nearly 400 programs on 27 disks (so far, there are no plans to make them available on tape). Each disk is now packaged separately – available for $6.95 – with descriptions of each program on the back.

The disks are grouped in nine categories: business, geography, English, math, computer science, technology, science, history, and educational games. Some of the categories, such as math and English, are on more than one disk. There are seven English and eight math disks, with programs arranged loosely according to complexity. The three game disks have word-guessing puzzles, logic games, I.Q. simulations, and many other programs. Although they aren't available on tape, cassette users may copy them freely from someone with a disk drive, because the programs are not copyrighted and are unprotected.

Commodore is now working on yet another collection of educational programs, according to company spokesmen. The exact contents and the date of release are not yet definite, but the new batch will be available in the same format and at the same price as the revised disks. If all goes according to plan, they might be available before Christmas.

These public-domain educational programs are not being offered in isolation. Commodore is pushing software in general and educational programs in particular. Back in June, when the revised disks were announced, the company also slashed its regular software prices by up to 50 percent, and introduced 70 new programs, including word-processing and small-business packages.

Then, during the summer, Commodore announced an agreement with the Minnesota Educational Computer Consortium (MECC) to produce 100 educational programs. MECC, a leader in educational computing, will rewrite its 100 best programs for the 64. MECC will begin offering these versions to schools this fall and should have them all completed by the end of the school year, June 1984. Also, recognizing that the home and educational markets are merging, Commodore will make these programs available through both its dealer network and mass distributors.

Finally, Commodore is improving service to schools by sponsoring more seminars on educational computing and by designating some dealers as educational specialists – equipped and trained to give top-quality service to educational buyers.

This is good news for schools, but it doesn't leave out the home user, either. MECC's software will be available at a cost similar to games and other commercial software. And the public-domain material averages less than $1 per program. At that price, you can get a baker's dozen of engaging programs for little more than the cost of a blank disk.

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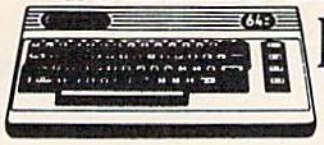

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A Survey Of Inexpensive Word Processors For VIC And 64

Larry L. Bihlmeyer and Kathy Yakal, Editorial Assistant

Word processing software and hardware for the Commodore 64 and VIC-20 is growing by leaps and bounds. Besides many new releases, older programs are being updated and re-released.

This all goes to show the competitive battle going on to capture buyers (you). At the same time, features usually found in more expensive word processing programs are working their way into lower-cost editions: color capabilities, word count calculations, addition/subtraction of columns or rows of numbers.

If you are shopping for a word processor for your VIC or 64, you can quickly become confused. Let's clear up the confusion and see what's available. In the process, we'll answer some key questions. Such as: What do you get for your money? Which programs support the RS-232 port? How do word processing programs on cartridges compare to those on tape and disk? Are there many low-cost word processors to choose from?

Define Your Needs

Before we look at the low-cost programs, you first need to know what your needs are and what equipment you'll be using. This is vital because many programs support only the serial port (device #4) on Commodore machines. Thus, if you use the RS-232 port (device #2) with a printer interface, you could end up with a word processing program that won't work with your printer. Figure 1 shows the two possible printer hookups to a Commodore 64.

To determine your needs, make a list of how you would use a word processor if you had one. Remember that a word processor is more than just an electronic typewriter. A good word processing program can help you store information, prepare charts and newsletters, do form letters to use with mailing lists, and even do small budget sheets.

So make a list of what you expect a word processor to do. Are you going to jot short letters to your friends, or write a novel that rivals *War and Peace*? Do you need mailing list capability? Do you have a disk drive or a tape recorder?

Once you've defined your needs, list the kind of equipment you have or plan to buy which must be compatible with the word processor. What kind of printer (parallel or serial)? Will a printer interface be used, such as a Data 20 Printer Interface for the RS-232 port? Or will you use a Commodore printer connected to the serial output jack? Do you plan to add a disk drive in the future?

A Variety Of Features

When you've finished both these lists, it's time to see what word processors match your needs and equipment. Table 1 lists word processing programs and some of their features. Table 2 lists the company addresses.

These programs basically fall into three price groupings: $15-$30, $30-$65, $65-$125. In general, the more you pay, the more features you get. But there may be a limit to what you might need. Maybe you don't need more than just "basic" word processing capabilities. This will, of course, depend on your needs list.

The programs in the $15-$30 range contain the basic word processing commands. For example, *TOTL.Text 2.0* ($25) for the VIC-20 has 16 basic features, including page numbering, right and left margin control, centered title lines, tabs, full-screen editing, full cursor control, scrolling up and down, and editing of blocks of text. *TOTL.Text 2.5* ($35), an enhanced version of *2.0*, adds nine more features, such as headers and footers, keyboard input for form letters, and added printer controls. For the Commodore 64, you can buy *TOTL.Text 2.6+* ($40), which has about 25 features and supports both the serial and RS-232 ports.

Word Processor Plus ($25) provides good basic features including repeating keys, a standard letter format output, and a spool routine to print a series of text files.

The second price grouping ($30-$65) moves you up to more features, longer manuals in binders, and sample text files to help you learn the program. For example, *Quick Brown Fox* (VIC or 64) comes with a nice binder

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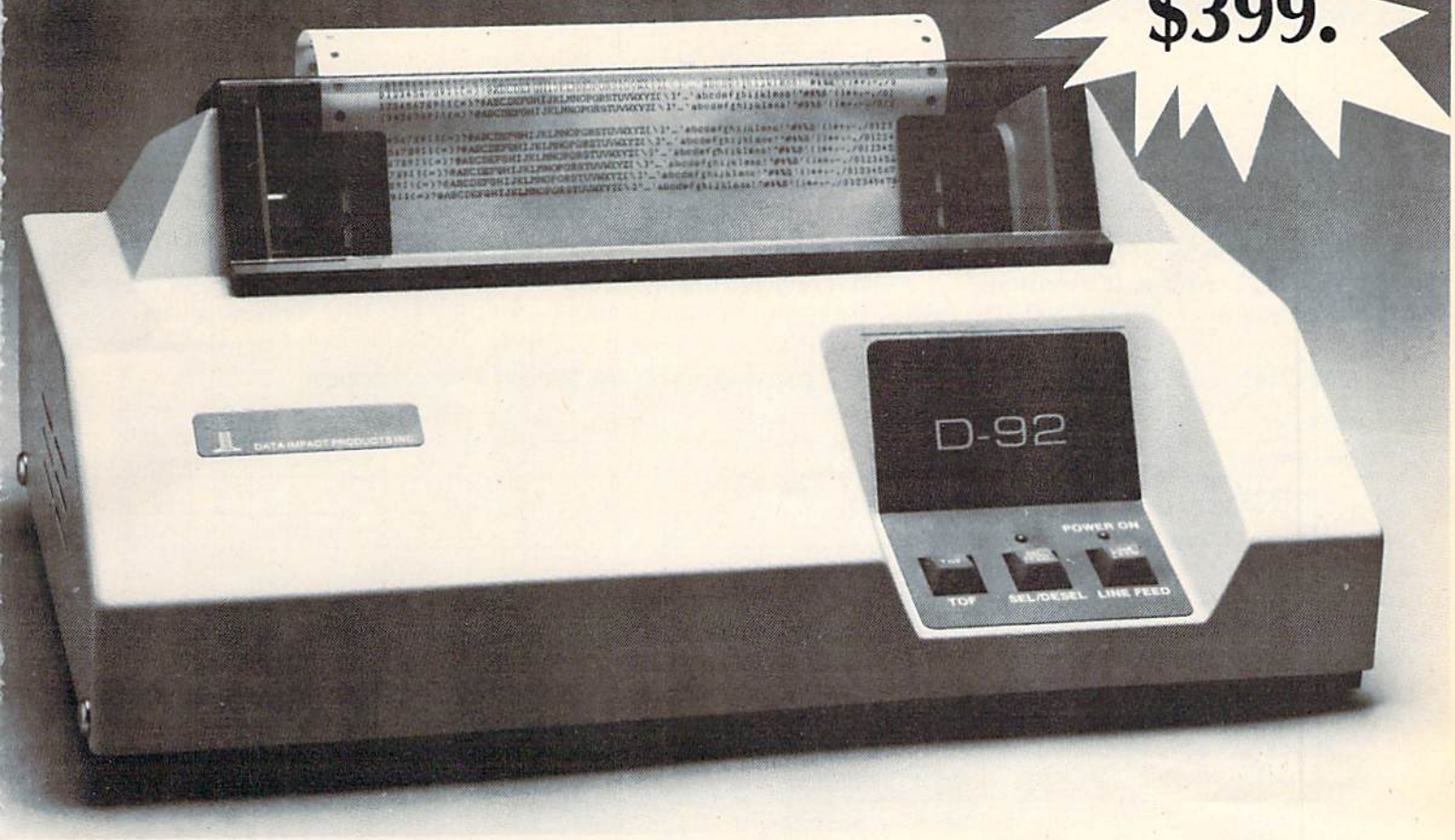

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and a cassette tape with sample files to aid learning. It's written for the beginner and the instructions contain lots of illustrations.

Quick Brown Fox is a "firmware" program, in that it comes as a cartridge which slides into the cartridge slot at the right rear of the 64 or VIC. This means it

Table 1: Summary Of VIC-20/Commodore 64 Word Processors

PRODUCT	VIC	64	TAPE	DISK	CART.	Price,$*	COLOR	SERIAL†	RS-232	COMMENTS‡
Casual Writer	X		X			29	N	Y	N	Requires 8K expansion on VIC
EasyScript 64		X		X		79.95	Y	Y	Y	
The Editor	X	X	X	X		34.95	N	Y	N	Requires 8K expansion on VIC
HES Writer	X				X	39.95	Y	Y	N	
HES Writer/64		X			X	44.95	Y	Y	N	
Page-Mate	X	X	X	X		40	N	Y	Y	
PaperClip		X		X		125	Y	Y	Y	
Quick Brown Fox	X	X		X	X	65 (cart.)	N	Y	Y	
Smithwriter		X	X	X		49.95 (tape) 54.95 (disk)	Y	Y	Y	VIC version available soon
Script 64		X		X		99.95	Y	Y	Y	
TOTL.Text 2.0	X		X	X		25 (tape)	Y	Y	Y	Disk version is $29
TOTL.Text 2.5	X		X	X		35 (tape)	Y	Y	Y	Disk version is $39
TOTL.Text 2.6		X	X	X		40 (tape)	Y	Y	Y	Disk version is $44
Un-Word Processor	X		X			20	N	Y	Y	
VIC-NIC	X		X	X		19.50	Y	Y	Y	Commodore 64 version available soon
Word Manager	X	X	X	X		Free with purchase of Data 20 Video Pak	N	Y	Y	Requires Video Pak
Word Mite Plus	X		X			14.95	Y	Y	N	
Word Mite 2	X		X	X		14.95 (tape) 16.95 (disk)	Y	Y	N	
Word Mite 2C		X	X	X		14.95 (tape) 16.95 (disk)	N	Y	N	
Word Pro 1 Plus/64		X	X	X		39.95	Y	Y	N	
Word Pro 3 Plus/64		X	X	X		89.95	Y	Y	N	
Word Processor Plus	X	X	X			25	N	Y	Y	
Word Wizard	X		X			34.95	N	Y	Y	Requires 8K expansion on VIC
Word Wonder	X	X	X	X		29.95 (VIC-20) (price for 64 version was not available at press time)	Y	Y		Requires 8K expansion on VIC
Wordcraft	X	X			X	99.95 without 8K expansion (VIC) 199.95 with 8K expansion; 64 version 149.95	Y	Y	Y	
Wordwiz	X		X			14.95	Y	Y	N	
Write Now	X	X			X	39.95 (VIC) 49.95 (64)	N	Y	N	
Writer's Assistant		X		X		125	Y	Y	Y	

* Suggested retail price at press time.
† Refers to whether program can be used with a printer connected to this port.
‡ Unless noted, VIC-20 version will run on an unexpanded VIC.

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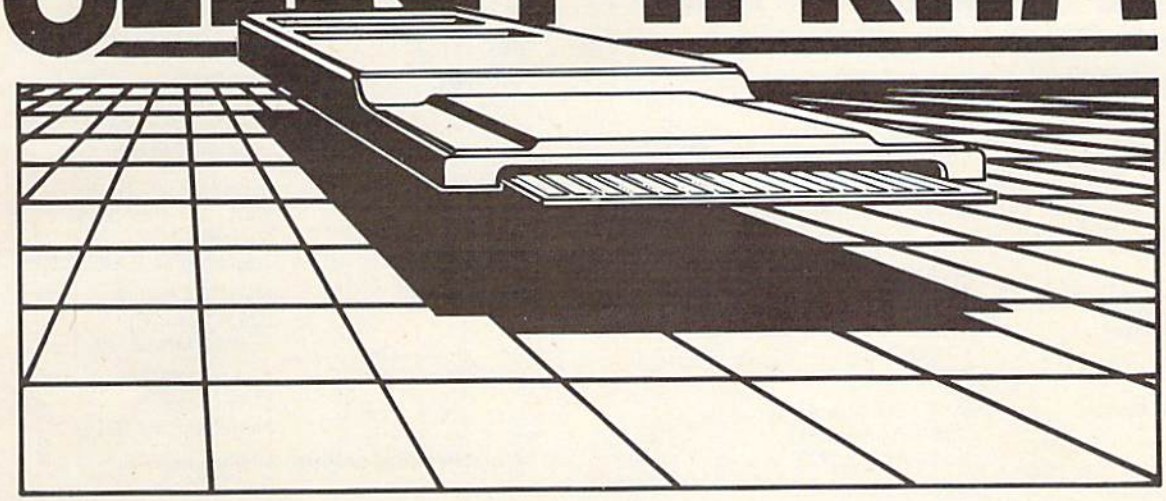

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Table 2: Manufacturers Listing

PRODUCT	COMPANY ADDRESS
Casual Writer	E. N. Publications R.D. 1 Worden, IL 62097
EasyScript 64	Commodore Business Machines, Inc. 1200 Wilson Dr. West Chester, PA 19380
The Editor	Powerbyte 2 Chipley Run West Berlin, NJ 08091
HES Writer	Human Engineered Software 71 Park Lane Brisbane, CA 94005
Page-Mate	AB Computers 252 Bethlehem Pike Colmar, PA 18915
PaperClip	Batteries Included 71 McCaul St. Toronto, Ontario Canada M5T 2X1
Quick Brown Fox	Quick Brown Fox 548 Broadway Suite 4F New York, NY 10012
Smithwriter	Softsmith 2935 Whipple Ave. Union City, CA 94587
Script 64	Pacific Coast Software 3220 S. Brea Canyon Rd. Diamond Bar, CA 91765
TOTL.Text	TOTL Software, Inc. 1555 Third Ave. Walnut Creek, CA 94596
Un-Word Processor	Midwest Micro Inc. 311 W. 72nd St. Kansas City, MO 64114
VIC-NIC	Type Thrift Dept. K Shelburne, Ontario, Canada L0N 1S0
Word Manager	Data 20 Corporation 23011 Moulton Pkwy. Suite B10 Laguna Hills, CA 92653
Word Mite	Nelson Software 2232 Ogden Ct. St. Paul, MN 55119
WordPro	Professional Software, Inc. 51 Fremont St. Needham, MA 02194
Word Processor Plus	William Robbins Box 3745 San Rafael, CA 94912
Word Wizard	Micro-Ware Dist., Inc. 1342 B Rt. 23 Butler, NJ 07405
Word Wonder	Microspec 2905 Ports O'Call Ct. Plano, TX 75075
Wordcraft	UMI 3503-C Temple Ave. Pomona, CA 91768
Wordwiz	World Electronics 177 27th St. Brooklyn, NY 11232
Write Now	Cardco 313 Mathewson Wichita, KS 67214
Writer's Assistant	Rainbow Computer Corporation 490 Lancaster Ave. Frazer, PA 19355

comes on instantly when you turn on your computer, so there is no waiting to load the program. However, the 64 version requires loading a short tape utility program before using a printer with the RS-232 port.

HES Writer 64 ($45) also is a cartridge program. It has 15 program commands and 14 format controls (for printing), making it a complete package. It supports the Commodore serial port but not the RS-232 port at this time.

The third price group ($65-$125) puts you on the borderline of full-feature business-type word processors. Two good examples are *PaperClip* ($125) and *Writer's Assistant* ($125). Both are for the Commodore 64 only and come on disks. *PaperClip* contains many advanced features, such as horizontal scrolling, addition/subtraction of columns or rows, column changes (edit whole columns at one time), and alphanumeric sorting. By the time you read this, it should be available in an updated form which supports the RS-232 port, and which has expanded printer files, wider horizontal scrolling, and improved manuals and operation.

PaperClip comes with a "dongle" which fits into control port #1 (usually used for joysticks). This is for copy protection purposes – unauthorized copies will not run without the dongle.

A similar program, *Writer's Assistant* ($125), comes on disk and contains several sample files. For example, a "Demo for Writer" file shows many of the printing features and a "Glossary Sample" file shows you how to store frequently typed information to

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32K TRS 80 COLOR Version $29.95.
Adds a second level with dungeons and more Questing.

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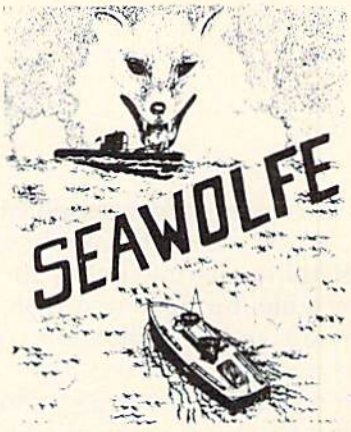

SEAWOLFE – ALL MACHINE CODE In this high speed arcade game, you lay out patterns of torpedoes ahead of the attacking PT boats. Requires Joysticks, at least 13k RAM, and fast reflexes. Lots of Color and Sound. A fun game. Tape or Disk for Vic20, Commodore 64, and TRS-80 Color. NOTE: tape will not transfer to disk!
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avoid retyping it when used later.

Writer's Assistant also has a disk utility menu to help you copy a file, format a new disk, generate and list a directory, rename a file, and kill a file. When you first use it, you configure it to your system and it will then remember this each time you start up. Another nice feature is the "date" format. When you first start the program, it asks you the current date. Then, whenever a date is needed, it puts in the value you gave it.

Is It Comfortable?

By now, you can see the wide range of word processing programs available for the VIC and 64. Cartridge programs offer faster start-up, since they basically become part of your computer's operating system. However, they may not easily support your printer if you are using the RS-232 port.

One way to make your final selection is to narrow your choices down to two or three with the features you want, then contact each company or local dealer for specific information about the latest version, printer and interface support, cost, memory needs, and other criteria.

With this information, a final selection shouldn't be hard to make. Then, when you get the program home, give it a good workout, allowing enough time to learn all the features carefully. Only then will you actually be able to rate the program for yourself. Ask yourself: Is the word processor fun to use? Since you'll be using it for creative purposes, it shouldn't inhibit you. After all, if it isn't fun to use, it'll just gather dust and soon be forgotten.

If the word processing program you select just doesn't "fit" right, return it for a refund or credit towards another program. Most companies will work with you to resolve any problems, perhaps by making updated versions available at a nominal cost.

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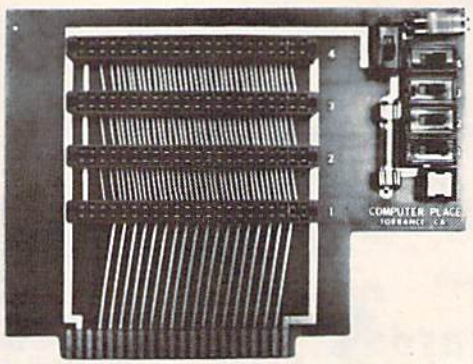
The CP Numeric Keypad is the best friendly companion of your Commodore 64 and VIC-20. It is designed with top quality, low profile key switches for smooth, reliable and low-cost data entry. It lets you zip through your numeric work sheet, input your numbers and figures comfortably, quickly, and more easily than ever before. The keypad easily connects in parallel with the existing keyboard connector. No additional software is required. The setup is simple. The usage is comfortable. And the price is very affordable at only $69.95.



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WordPro 3 Plus/64

Dan Carmichael, Assistant Editor

Editing text with WordPro 3 Plus/64.

One of the more useful tools to emerge from the computer revolution is the word processor.

A word processor enables you to compose and edit text on the TV screen by inserting or deleting letters, words, or sentences at will. You can rearrange whole paragraphs within a document, or move them to another document. You can store the text on peripheral storage equipment, such as tape or diskette, to be recalled, edited, and printed at any time.

Some word processors even have a standard data bank of tens of thousands of words. The computer can use this "dictionary" to check your spelling or your syntax. All this can be done within the computer before ink ever touches the paper.

A Wealth Of Options

WordPro 3 Plus/64 is a word processor that is written to work with the Commodore 64 computer, a disk drive, and a printer. Although it does not contain all of the above options, it does have all the features that the home computerist or the small business user is likely to need. This, plus its budget price (about $89), makes it a good buy.

Among *WordPro 3 Plus/64*'s options is *insert/delete*, in which anything from a single letter to whole paragraphs can be easily inserted or deleted. The ability to work with *global* files allows you to link many files together for use with the various commands. This means you can print out a document much larger than the computer's memory by breaking it up into smaller files which are hooked together and treated as a single document. Another option is the *search* and *replace* command. This allows you to scan the entire text to search for and replace any words you wish. For instance, you might want to replace all occurrences of "Smith" with "Smythe." *WordPro* will do this automatically.

Options to format the printed output are also included. These include variables for page numbers, line spacing, centering lines of text, right and left justification, and the setting of tabs. *WordPro* for the 64 also supports subscripts, superscripts, and underlining – if these options are also supported by the printer.

For the small business user or for those interested in accounting applications, there is a *numeric mode*. In the numeric mode, *WordPro* automatically aligns columns of numbers by their decimal points.

Another advanced feature of *WordPro 3 Plus/64* is the "boilerplate" or *extra text mode*. The extra text mode is much like having an "alternate memory" area in *WordPro*. This enables you to call in or reuse a standard paragraph or a whole file. This option can be used when generating form letters that contain the same standard paragraph. For example, when writing the form letter you can "call in" or add the standard paragraph to your text with a simple command.

The screen display on your TV or monitor can be adjusted with *WordPro*. You have the option of separately changing the screen background color and the print (text) color.

One option missing from *WordPro 3 Plus/64* is the ability to preview on the screen how the formatted output will appear on paper. This is because the screen display is limited to 40 columns while the printer output is set at 80, and *WordPro 3 Plus/64* does not support horizontal scrolling.

Other options include a small library of standard disk commands which include: FORMAT, INITIALIZE, VALIDATE, DUPLICATE, COPY, RENAME and SCRATCH.

A Few Flaws

Although a fairly good word processor, *WordPro 3 Plus/64* does have a number of flaws that could cause problems if you're not careful. In certain circumstances, if you press the wrong key at the wrong time, all

Pressing certain adjacent keys at the same time, such as Commodore-RUN/STOP, can erase all your text and restart the program.

your text can be lost.

For instance, the Commodore key on the Commodore 64 keyboard is used as a CTRL key. If you press the control key and then inadvertently press the RUN/STOP key (the key next to it), the computer will completely reset *WordPro*, and destroy any text you were working on. The same thing happens if you type a capital "Q" after the CTRL key is pressed.

These and other flaws revolve around one area of design of *WordPro 3 Plus/64*. The program does not ask, or double-check, to make sure you want to execute a certain option or command. In the previous example, it would seem more efficient to ask the user, "Are you sure you want to reset *WordPro*?" If the keys were indeed accidentally pressed, you could then recover with no loss. *WordPro* doesn't ask; it simply resets, and the text is gone. Because there are so many commands available which will erase or delete some or all of the text, such a "fail-safe" system would be welcome.

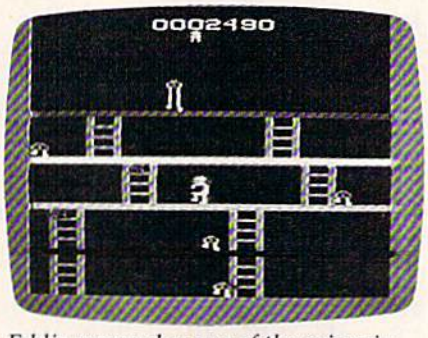
WordPro 3 Plus/64 comes with a relatively well-written instruction manual. The manual contains thorough explanations of each command, along with format illustrations, and some step-by-step examples. However, there is no quick reference card. A quick reference card was included with *WordPro* versions for other computers (PET, etc.) and should have been included with the Commodore 64 version.

WordPro 3 Plus/64
Professional Software, Inc.
51 Fremont Street
Needham, MA 02194

Fast Eddie For VIC And 64

Tony Roberts, Assistant Managing Editor

If you can run faster, jump farther, and climb higher, get ready to put yourself into the shoes of Fast Eddie, the protagonist in a new game by the same name from Sirius.



Eddie approaches one of the prizes in Fast Eddie.

It won't really matter, though, whether you can outdo your friends at the decathlon. For to play *Fast Eddie*, all you need is perfect eye-hand coordination and a comfortable joystick.

Versions of *Fast Eddie*, which was designed by Mark Turmell, are available for the Commodore 64, the VIC-20, and Atari. The VIC and 64 versions were programmed by Kathy Bradley.

In the game, you assume the persona of Fast Eddie, a somewhat barrel-shaped fellow in a green coat. Your goal is to collect prizes, which float near the ceilings of the first four floors of your building. Because of your superior leaping ability, it's no trouble for you to simply jump up and bring down a prize. A touch of the fire button is all it takes.

Collect nine prizes, and a key appears above High-Top, the creature who lives up on the fifth floor. Capture the key and you move on to a new screen and new prizes.

Sneakers And Ladders

The Sneakers, short-legged relatives of High-Top, are the turned ankles in this track-and-field style game. These dancing semicircles with eyes guard the prizes and keep Eddie moving. Eddie can outrun the Sneakers, hop over them, or climb aboard a ladder to another floor. But if he is caught, Eddie is through, and one of the reserves takes over back on the first floor.

You have four Fast Eddies at the start of each game, and, if you have fewer than three in reserve when you complete a screen, you get an additional Eddie.

Generally, the ladders that connect the floors of Eddie's building are easy enough to negotiate, and while Eddie is climbing, he needn't worry about getting the boot from one of the Sneakers.

Most of the time, the ladders are staggered. After climbing up a floor, for example, Eddie must move right or left to board another ladder to another floor. Some ladders, however, are aligned. On these structures, it's

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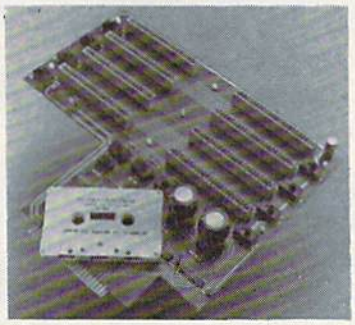

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all too easy to zip past the intended floor, and wind up in deep, unexpected trouble.

Sneakers In All Sizes

Eight levels are available in *Fast Eddie*, each with five screens. If you complete the five screens of one level, you automatically move to the next higher level. You also can use the f5 key to start the game at any level.

At each level, the objective is the same: collect nine prizes and the key. The differences between levels can be found in the Sneakers.

At level one, a single Sneaker guards each of the four floors. At level two, you'll find a pair up on deck four. At level three, there is a pair on the second floor, another pair on the fourth, and an extra-wide model on the third floor.

In some cases, two Sneakers will be positioned side by side, requiring that Fast Eddie leap them in a single bound. In other cases, they'll be strewn far apart, making Eddie negotiate them in a series of jumps.

Beginning at level six, you'll see three Sneakers on some of the floors. If the three are close together, it will take a perfectly timed jump to clear the bunch. If they are spaced apart, you'll need a pogo stick to get across the screen.

He's Not Called Fast For Nothing

Once Fast Eddie gets going, he can really move. The program itself is fast and colorful, and the action is smooth. Inexperienced players will be able to enjoy the lower levels of *Fast Eddie* and work their way up. Old hands at the joystick will find plenty here to challenge them.

When being guided by a practiced hand, Eddie will look inspired. His running, jumping, climbing, and countless close calls will leave you breathless and exhausted.

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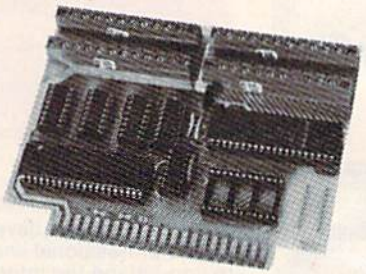

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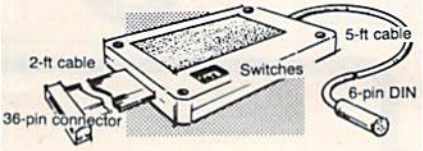

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HINTS&TIPS

A SHIFTy Solution

Steven Darnold

If you've discovered a clever, time-saving technique, or a brief but effective programming shortcut, send it in to "Hints & Tips," c/o COMPUTE!'s Gazette for Commodore. If we use it, we'll pay you $35.

Most programs need to pause at some point to give the user time to read instructions or other information on the screen. Often this is done by putting the computer into a loop:

```
50 GET G$ : IF G$=" " THEN 50
```

and instructing the user to "Press any key to continue."

This approach, however, is somewhat clumsy. The loop requires a separate line all to itself, it adds a byte of variable garbage every time it is used, and it permits inexperienced users to break out of the program by pressing the RUN/STOP key.

A much more elegant approach is to use WAIT 653,1 and instruct the user to "Press SHIFT to continue." On both the VIC-20 and the Commodore 64, memory location 653 contains a 1 whenever the SHIFT key is down. WAIT 653,1 is shorter, faster, and neater than the usual GET loop.

If there are several pages of instructions with a WAIT 653,1 at the end of each page, the user can skip through them simply by holding down the SHIFT key. If this is undesirable, the program can check to see that the SHIFT key is released each time. This is done with a WAIT 653,1,1. Example:

```
10 PRINT "Press and release SHIFT to continue."
20 WAIT 653,1
30 WAIT 653,1,1
40 PRINT "Continued, OK"
```


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C. REGENA

Program Transfer

My apologies to all those who were not able to RUN my previous sample programs on a Commodore 64! Until now, I didn't own a 64. Then I braved the early-summer Utah floods and crossed a newly formed river down the center of Salt Lake City to get to a computer store. I now have a new Commodore 64 sitting next to my VIC-20 so I can make sure my examples and sample programs work equally well on both computers.

Most of the BASIC programming techniques are the same for both computers. Differences are largely because the Commodore 64 has different memory locations and because the 64 has more rows and columns available on the screen than does the VIC. A full printing line on the VIC takes up only about half a line on the 64. The screen memory maps, therefore, use different numbers. Any numbers involved in POKE commands for graphics and colors will be different for the computers. Numbers used in the POKE commands for music are also different. In addition, the 64 has features available that are not possible with the VIC.

My previous columns have discussed graphics and music on the VIC. I usually like to start with graphics and music because they are features that make a home computer *fun*. Once you experiment with graphics and music, you can really be creative. In this column I'm going to go back and discuss some of the fundamentals of BASIC programming.

Each program line in a BASIC program has a line number. When you RUN the program, the computer executes each line in exact numerical order, *unless* ... unless you tell the computer otherwise. Directing the program to go somewhere else can be called "program transfer" or "branching" and often involves "logic" that really enables the computer to make decisions. Following are some of the branching commands available in Commodore BASIC.

GOTO

The most direct command to go to a different line is GOTO *n*, where *n* is a line number, such as GOTO 550. A command may tell the computer to skip several lines and GOTO a later line number, or to back up and GOTO a previous line number, or even to stay at a certain line number by a GOTO to itself. Here is an example:

```
10 REM PROGRAM STARTS HERE
20 PRINT "HELLO"
30 GOTO 70
40 PRINT "THIS IS LINE 40"
50 PRINT "PRESS RUN/STOP KEY"
60 GOTO 60
70 PRINT "THIS IS LINE 70"
80 GOTO 40
```

The computer starts executing the lines in order, starting with line 10 (which is actually ignored because of the REMark statement). Next is line 20, which prints a message. Line 30 says to GOTO line 70 without paying attention to any lines in between. Line 70 then prints a message. Line 80 branches again – this time GOTO 40. Line 40 prints a message, then line 50 prints a message. Line 60 says GOTO 60. The computer will just stay at line 60 (an "endless loop") until you press the RUN/STOP key.

You can probably see that using GOTO statements isn't the most efficient programming technique. It can make programs hard to understand.

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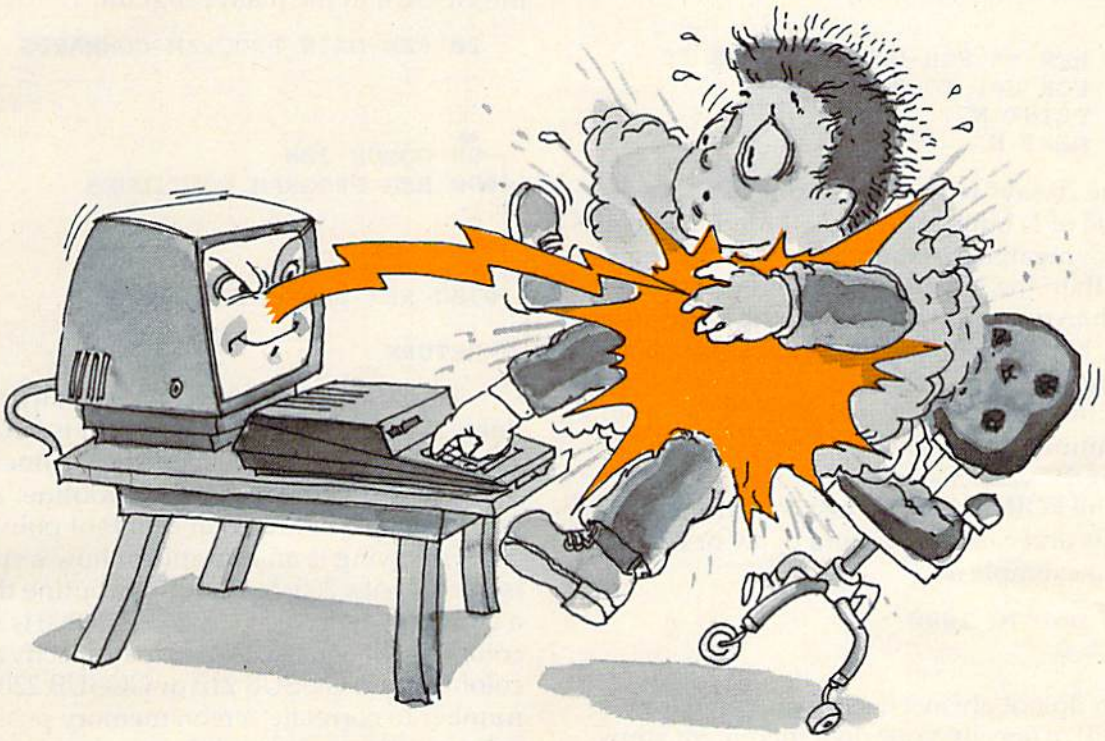

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Many structured-programming advocates say you should rarely or never use a GOTO. Good program planning can at least minimize the GOTOs. Some of my early programming efforts used lots of GOTOs. My husband teasingly said it was good program security – no one could follow all the branching to figure out the program.

GOTO may also be typed GO TO (with a space between the words). The abbreviation is G shift O.

FOR-NEXT

A FOR-NEXT loop is used when you want to perform a process by repeating lines a certain number of times.

```
10 REM ** FOR-NEXT EXAMPLE **
20 FOR N=1 TO 8
30 PRINT N
40 NEXT N
```

Line 20 says to let the variable N start with the value of 1. Line 30 prints N. Line 40 says NEXT N, which means increment N by 1 and see if it is greater than the limit of 8 specified in line 20. If N is less than or equal to the limit, the computer goes back to line 30. Now the value for N is 2, and the computer prints "2" as N. The process continues until the limit of 8 is reached. The program then continues with the next line.

A FOR-NEXT loop with no commands between the FOR and NEXT just counts between the limits and can be used as a delay or timing loop. An example is:

```
20 FOR D=1 TO 1000
30 NEXT D
```

You do not always need to increment by 1. Use STEP to specify your own increment steps.

```
10 REM ** FOR-NEXT-STEP **
20 FOR N=1 TO 8 STEP 2
30 PRINT N
40 NEXT N
```

RUN this program to see the difference STEP makes. Try changing the 2 in line 20 to 3. You may even use a fraction such as .5. There are also times when you may want to use a negative step size. Try changing line 20 to:

```
20 FOR N=10 TO -6 STEP -2
```

All the numbers in the FOR statement may be variables and expressions, such as FOR N=X TO Y+5 STEP S.

To conserve memory, you may leave out spaces in the FOR and NEXT statements. However, if you use variables as the limits, you must have a space after the variable name. Examples:

```
20FORN=1TO8STEP2
20 FORN=X TOY+5 STEPS
```

You may also use abbreviations. FOR may be abbreviated F shift O, NEXT may be abbreviated N shift E, and STEP may be abbreviated ST shift E.

GOSUB

GOSUB means GO to a SUBroutine, then come back to execute the next line. A *subroutine* is a set of instructions that may be used several different times during the execution of the program. The subroutine may be placed anywhere in the program. The last statement of the subroutine is RETURN to branch back to the next statement after the GOSUB in the main program.

```
20 REM MAIN PROGRAM COMMANDS
 .
 .
80 GOSUB 300
90 REM PROGRAM CONTINUES
 .
 .
 .
300 REM SUBROUTINE HERE
 .
RETURN
```

The subroutine may consist of any number of lines, as long as the last command is RETURN. The GOSUB command specifies the line number of the first statement in the subroutine. A subroutine may be entered at different points.

Following is an example of how a subroutine is used. Lines 200-340 are a subroutine that draws a border using color C. If GOSUB 200 is used, the color C is set equal to 2. You may specify a different color C, then GOSUB 210 or GOSUB 220. A is the number to correlate screen memory position with color positions. A may be a number used in other calculations, then reset when the subroutine is entered.

Line 10 clears the screen. In the Commodore 64 version, line 15 changes the screen to a white background. Line 20 prints a sample title. Line 30 says GOSUB 200, which goes to the subroutine starting at line 200 and executes the statements until the command RETURN. Line 40 is the next line executed, which delays slightly. Line 50 and line 60 clear the screen and print a different sample title. Line 70 "primes" the subroutine by specifying color C=6. Line 80, GOSUB 220, goes to the subroutine starting with line 220, and executes until the RETURN command at line 340. Line 90 delays, line 100 clears the screen, and line 110 repeats the subroutine again, this time starting at line 200.

VIC-20 Version

```
5 REM ** GOSUB **
10 PRINT "{CLR}{BLU}"
20 PRINT TAB(5);"{6 DOWN}TITLE SCREEN"
```

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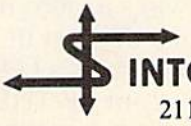

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```
30 GOSUB 200
40 FOR D=1 TO 1500:NEXT
50 PRINT "{CLR}{RED}"
60 PRINT TAB(6);"{6 DOWN}GOSUB DEMO"
70 C=6
80 GOSUB 220
90 FOR D=1 TO 2000:NEXT
100 PRINT "{CLR}{BLU}"
110 GOSUB 200
120 END
200 C=2
210 A=30720
220 FOR S=7703 TO 7722
230 POKE S,90:POKE S+A,C
240 NEXT S
250 FOR S=7744 TO 8140 STEP 22
260 POKE S,90:POKE S+A,C
270 NEXT S
280 FOR S=8162 TO 8143 STEP -1
290 POKE S,90:POKE S+A,C
300 NEXT S
310 FOR S=8121 TO 7725 STEP -22
320 POKE S,90:POKE S+A,C
330 NEXT S
340 RETURN
```

Commodore 64 Version

```
5 REM ** GOSUB **
10 PRINT "{CLR}{BLU}"
15 POKE 53281,1
20 PRINT TAB(14);"{8 DOWN}TITLE SCREEN
30 GOSUB 200
40 FOR D=1 TO 1500:NEXT
50 PRINT "{CLR}{RED}"
60 PRINT TAB(15);"{8 DOWN}GOSUB DEMO"
70 C=6
80 GOSUB 220
90 FOR D=1 TO 2000:NEXT
100 PRINT "{CLR}{BLU}"
110 GOSUB 200
120 END
200 C=2
210 A=54272
220 FOR S=1065 TO 1102
230 POKE S,90:POKE S+A,C
240 NEXT S
250 FOR S=1142 TO 1942 STEP 40
260 POKE S,90:POKE S+A,C
270 NEXT S
280 FOR S=1982 TO 1945 STEP -1
290 POKE S,90:POKE S+A,C
300 NEXT S
310 FOR S=1905 TO 1105 STEP -40
320 POKE S,90:POKE S+A,C
330 NEXT S
340 RETURN
```

GOSUB may be abbreviated GO shift S, and RETURN may be abbreviated RE shift T.

IF-THEN

The IF-THEN statement is a conditional branching statement that makes the computer seem intelligent. The computer evaluates a condition or expression, then branches or takes actions accordingly. The branching occurs only if the condition exists, or if the expression is true. The IF-THEN statement may be of the following forms:

IF *expression* THEN *line number*
IF *expression* THEN *action*

The *expression* may be a variable, string, number, comparisons, or logical operators. The *line number* is a line number of another statement in the program. Only if the expression is true will the program branch to the line number.

```
10 REM ** IF-THEN **
20 A=1
30 A=A+1
40 IF A<11 THEN 20
50 END
```

At line 40, if the value of A is less than 11, then the computer will branch to line 20. Another way of thinking or interpreting this statement is if the expression A<11 is true, then branch to line 20. RUN the sample program to see what happens.

Rather than a line number after THEN, you may specify an *action*, or several commands. Here is an example:

```
10 REM ** IF-THEN **
20 FOR A=1 TO 10
30 IF A<6 THEN PRINT A
40 NEXT A
50 PRINT "A =";A
60 END
```

In this sample program, the FOR-NEXT loop allows A to be from 1 to 10, but line 30 prints only the numbers less than 6. After the FOR-NEXT loop is completed, the final value of A is printed. (Note that A has been incremented 1 more than the limit of 10.)

String variables and string comparisons are allowed in IF-THEN statements. Here is a simple example.

```
10 REM ** STRING COMPARISON **
20 N$="HELLO"
30 M$="HI"
40 PRINT "ENTER 'HI' OR 'HELLO'"
50 INPUT A$
60 IF A$=N$ THEN PRINT M$:GOTO 80
70 PRINT N$
80 END
```

This time the action in line 60 actually consists of two commands – PRINT M$ then GOTO 80. If the condition A$=N$ is not true, the computer goes immediately to the next line and disregards anything after THEN in the present line. This program will print either HELLO or HI depending on what you type in and enter.

Keep in mind that in programming there are many ways to accomplish the same results. For example, the first IF-THEN example could have been written as a FOR-NEXT loop to produce the same output. IF-THEN statements may be written in a variety of ways. The expression to be evaluated also may be written in many different ways.

For example, a condition A<6 may be tested, but another way to write the same condition is A<=5 (A less than or equal to 5). Perhaps you would prefer to test the opposite condition, A>5 or A>=6 (A greater than 5 or A greater than or equal to 6). By the way, "not equal to" is written <>.

A word of warning: in general you may combine commands on one line by separating statements with the colon, such as 30 READ X:PRINT X. If you are translating a program and combining lines to save memory or typing effort, do NOT combine an IF statement with the next line. If the condition tested is false, program control goes to the next line; and the IF-THEN statement with the command(s) following THEN must be kept separate from the next line which contains different actions.

Math Competency: Saving Money

This month I am including a sample program that illustrates the use of various branching statements. The program writes out a story problem or word problem in arithmetic. The type of problem involves division calculations. A person needs to save a certain amount of money for a major purchase; how much needs to be saved each week?

FOR-NEXT statements are used in lines 40-90 to read in DATA from lines 100-110. N$(n) is the name for the problem, and there are six possible names (three girls and three boys). There are three kinds of purchases that can be made. A$(n) is the item desired. The price is chosen randomly. B( ) is the lowest base price for the particular item. A random factor from 1 to F( ) is chosen to multiply by M( ) to get the price of the item.

R6 is a random number from 1 to 6 to choose the person's name. R3 is a random number from 1 to 3 to choose the item.

Lines 470-510 are a subroutine that converts the price in raw form to dollars and cents. The subroutine may be entered at either line 480 or line 470. C$ is the cost in dollars and cents.

The logic in lines 200-220 determines whether to print "HE" or "SHE" depending on the random subscript R6 – the first three subscripts refer to girls, and the other subscripts refer to boys. Another way of doing this would be:

```
200 P$="HE"
210 IF R6<4 THEN P$="SHE"
```

(delete line 220)

After the student enters an answer, line 300 compares the INPUT answer with the calculated answer S; if they are within one cent, the program branches to the "Correct" procedure. If the answer is incorrect, lines 310-340 show how to get the correct answer. Line 330 uses GOSUB 470 to convert the answer S to the dollars and cents form of C$.

If the answer is incorrect, the student presses RETURN, and line 370 tells the computer to branch back to line 120 for another problem. If the answer is correct, lines 400-420 print the option to try again. The IF-THEN statements check the key the student presses and branch accordingly. If the key pressed is not Y or N, line 460 branches to line 430 to keep checking for a key pressed.

Commodore 64 owners, please add this line: 25 POKE 53281,1. This command creates a white background so you can read the blue letters. The program works for both VIC-20 and Commodore 64 (with the addition of line 25 for 64 users).

See program listing on page 155.

Writers

COMPUTE!'s Gazette is looking for well-written, clearly explained articles for beginning and intermediate users of VIC-20 and Commodore 64 personal computers. If you have an idea for a feature article or tutorial, submit a manuscript or send us a query letter.

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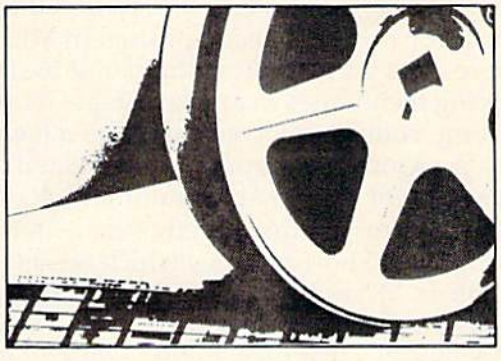

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MACHINE LANGUAGE FOR BEGINNERS

RICHARD MANSFIELD, SENIOR EDITOR

Windows And Pages

Last month we introduced the *disassembler*, a primary tool for machine language (ML) programming. With it, you can create ML equivalents of BASIC's LIST command. In other words, you can see a program on screen and follow its logic. Let's put the disassembler to work this month and also learn something about pages, datamakers, and ML "variables." If you don't have the disassembler program, you might want to send for a copy of the September 1983 issue of COMPUTE!'s Gazette.

One of the most effective ways to learn ML is to examine short routines in BASIC and then see how the same thing is accomplished in ML. After all, there are a fairly limited number of basic programming techniques in any language: looping, branching, comparing, counting, and a few others. And long programs are not created in a furious burst of nonstop programming. Rather, they are built by knitting together many small sub-programs, short routines which are as understandable in ML as they are in BASIC. In the months to come, we'll provide frequent, side-by-side BASIC-ML examples. Before you know it, you'll be able to think in both languages, and you'll have a working knowledge of ML.

Peering Into Memory

To start things off, type in either Program 1 (if you have a Commodore 64) or Program 2, for the VIC-20. These are called *BASIC Loaders*, and their function is to POKE a machine language program into RAM memory. The numbers in the DATA statements are the ML program. SAVE the program in case things go awry, then type RUN. Nothing seems to happen. You can then type NEW because the little loader has done its job: a short ML program is now in memory from address 864 to 875.

Program 1: 64 Loader

```
800 FOR ADRES=864TO875:READ DATTA:POKE A
    DRES,DATTA:NEXT ADRES
864 DATA 162, 0, 189, 0, 0, 157
870 DATA 0, 4, 232, 208, 247, 96
```

Program 2: VIC Loader

```
800 FOR ADRES=864TO875:READ DATTA:POKE A
    DRES,DATTA:NEXT ADRES
864 DATA 162, 0, 189, 0, 0, 157
870 DATA 0, 30, 232, 208, 247, 96
```

Because of the color memory problem (you have to POKE values into the entire color memory before you can see things), RUN this short BASIC line before trying out the ML program and after each time you clear the screen:

```
FOR I=55296 TO 55552: POKE I,6: NEXT  (64 version)
FOR I=38400 TO 38656: POKE I,6: NEXT  (VIC version)
```

To see what this ML program does, you can just SYS to the start of it: SYS 864. If you typed in the DATA statements correctly, you'll see a collection of strange symbols on the screen. Now clear the screen and type in Program 3. When RUN, it allows you to see things happening. Some characters are flashing rapidly, some change only in response to things you typed on the keyboard, some do nothing. What you're looking at is the first 256 memory addresses in your computer. The "flashing" characters (160, 161, and 162, counting down from the top left corner of the screen) are your computer's clock. They're what

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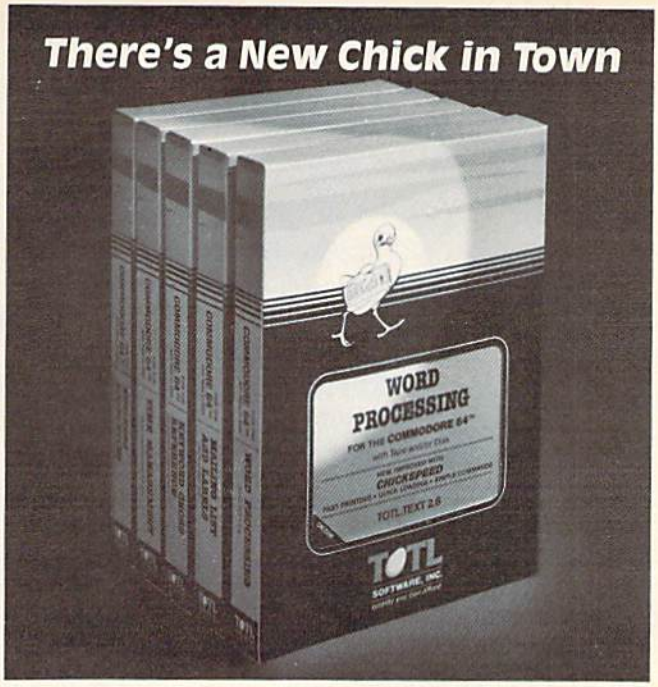

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Program 3: The Window

```
10 SYS864
20 GETK$
30 GOTO10
READY.
```

The computer divides its memory into groupings of 256 bytes, called *pages*. What you're seeing on screen is "zero page." Stop the program with the RUN/STOP key and type POKE 868,1. Then RUN the BASIC program again. Now you've changed the zero to a one, and you've changed the ML program so that it puts page one on screen. You can see any of the 256 pages in the computer by just POKEing the page number into address 868.

Comparing BASIC And Machine Language

How does this little ML program send the contents of RAM memory up to the screen? Let's show how we could do it in BASIC and then see how ML does it:

```
10 X=0
20 A=0+PEEK(X)
30 POKE 1024+X, A
40 X=X+1
50 IF X <> 256 THEN 20
```

Of course you would probably write a program like this using a FOR/NEXT loop, but we've distorted normal BASIC style a bit to more closely reflect the approach used in ML. Look at Program 4. It's the kind of disassembly you would see if you used a "monitor" program like Tinymon (published last year in COMPUTE! Magazine). The first column, starting with "0360" and containing a series of four-digit hexadecimal (hex) numbers, represents the addresses in memory where each ML instruction resides. (We'll get into hexadecimal arithmetic in a future column.) For now, it's enough that you understand that, in ML, memory addresses perform the same function as BASIC's line numbers do in a program LISTing.

Program 4: Monitor Disassembly

```
0360 A2 00     LDX #$00
0362 BD 00 00 LDA $0000,X
0365 9D 00 04 STA $0400,X
0368 E8        INX
0369 D0 F7     BNE $0362
036B 60        RTS
```

Program 5: Disassembler

```
starting address (decimal)? 864
start address hex  0360
 864  ldx   # 0
 866  lda  0 ,x
 868  sta   1024 ,x
 871  inx
 872  bne        866
 874  rts
```

After the "line number" address, you see some groupings of two-digit hex numbers. The first group is "A2 00." These are the actual numbers that the computer reads when it executes the ML program. These numbers are the most elemental form of machine language and sit in memory at the addresses indicated to their left. Finally, the "LDX #$00" is the disassembly (the *translation*) of the ML "A2 00." LDX means "LoaD the X register." The X register is like a variable and the # symbol tells the computer to load the *number* zero into the X – as opposed to the number found at *address* zero. Without the #, X would be given whatever number was currently in address zero. The $ means that the number is in hex notation, not decimal.

Now take a look at Program 5. If you have a copy of the disassembler program from last month's column, LOAD it. When it asks you for "starting address (decimal)", type in 864 and you'll see the same disassembly as illustrated in Program 5. Notice that 864 is translated into hex (0360). Program 5 is nearly identical to Program 4 except that the two-byte numbers between the address and the disassembly are not shown.

The second "line" in Program 5 "LoaDs the Accumulator" with the item in *address* zero + X. That is, if X is 5, then the item in 0+5 (address 5) is loaded into the accumulator. The accumulator is another "variable" in ML, used to hold things temporarily. Since we're trying to send all the items in zero page (addresses 0-255) up to the screen memory so we can see them, our next job is to "STore the Accumulator" at address 1024+X. (1024 is the starting address of screen memory on the 64.) As you can see, we're making X do double duty here as an "index." It's acting as an offset for both the source items (in zero page) as well as the target to which we're sending those items (screen memory).

The next line raises, or *increments*, X by 1. INcrement X causes X=X+1 to take place, so, this first time through the loop, X goes up from 0 to 1. The BNE means "Branch if Not Equal to zero." Branch is like a GOTO, but instead of giving a line number as its target, it gives an address in memory (866 in this case, the start of our loop). How does X ever get to zero if it's being INXed each time through the loop? No single-byte variable in ML can go higher than 255. (Likewise, no individual memory address in the computer can "hold" a number beyond 255. This is similar to the fact that no decimal digit can ever go higher than 9. After that, the digits "reset" to zero.) As soon as you've raised X to 255, the next time you INX, it resets itself to zero and starts over. So,

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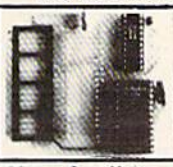

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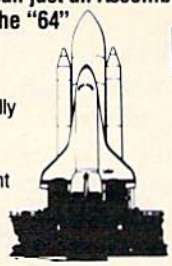

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"line" 872 in Program 5 will throw us back to line 866 until we've been through the loop 256 times. Then, we'll finally get to line 874, where "ReTurn from Subroutine" sends us out of ML and back into BASIC where we left off. Notice that SYS-RTS has the same effect as GOSUB-RETURN, except that the former moves between BASIC and ML.

Making A Loader Automatically

Program 6 is another useful tool when you're working with ML. Loaders (Programs 1 and 2) POKE an ML program into RAM memory for you; Program 6, "Datamaker," goes in the other direction and translates an ML program from RAM into a BASIC loader. After you type it in and SAVE it, try an experiment. To make a loader out of "The Window," change line 1 to read S=864:F=875:L=9. S is the starting address of your ML and F is the finish. Then RUN. You'll see the loader created for you on screen. The Datamaker destroys itself after it's finished. (Note: Sometimes it doesn't complete its job, and you need to hit RETURN a couple of times to help it out.) Notice, too, that the line numbers created in the loaders made by Datamaker are also the *addresses* where the ML will be POKEd. And don't forget to change the starting and ending addresses in line 800 before SAVEing a finished loader.

Program 6: Datamaker

```
0 QK=198:QB=630
1 S=826:F=1023:L=9:REM>S&F=ADRES
2 PRINT"{CLR}{2 DOWN}":FORI=STOS+47STEP6
  :IFI>FTHENNEXT:L=3:PRINT"QK="QK":QB="Q
  B":GOTO6":GOTO5
3 PRINTI;"DATA";:FORJ=0TO5:PRINTPEEK(I+J
  )"{LEFT},";:NEXTJ:PRINTCHR$(20):NEXTI
4 PRINT"QK="QK"{LEFT}:QB="QB"{LEFT}:S="S
  +48"{LEFT}:F="F"{LEFT}:L="L"{LEFT}:GOT
  O2"
5 POKEQK,L:FORK=1TOL:POKEQB+K,13:NEXTK:P
  RINT"{HOME}":END
6 PRINT"{CLR}{2 DOWN}":FORM=0TO7:PRINTM:
  NEXTM
7 POKEQK,8:FORK=1TO8:POKEQB+K,13:NEXTK:P
  RINT"{HOME}":END
800 FOR ADRES=826TO1023:READ DATTA:POKE
    ADRES,DATTA:NEXT ADRES
```

Next month we'll take a closer look at some of the events illustrated on screen when you RUN "The Window." You might try substituting INPUTK$ for GETK$ in Program 3 to try to find out where your input from the keyboard is temporarily stored in the computer before you hit RETURN and BASIC analyzes it. If you have any suggestions or questions, please write to me c/o COMPUTE!'s Gazette.

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Improved Paddle Reader Routine For VIC And 64

Dan Carmichael, Assistant Editor
Tom R. Halfhill, Editor

This fourth installment of "Power BASIC," a continuing series of useful utilities and routines, is an enhancement of the first "Power BASIC" which appeared in the July 1983 issue of COMPUTE!'s Gazette. It works on the Commodore 64 or VIC-20, any memory size.

The "Power BASIC" in our Premier Issue was a paddle reader routine for the Commodore 64. The idea was to reduce the "jitter" in screen objects controlled by the game paddles. This jittering is caused by minor fluctuations in the paddle's readings. To calm down the jitter, author Bobby Williams wrote a short machine language routine which read the paddle 256 times in a split second, averaged the readings, and used the average for a final paddle value.

The routine worked fine, but some readers wanted more. One person in particular wrote an amusing letter – in the form of a poem – asking why we had not provided a version for the VIC-20. True, for some reason the VIC is not afflicted with a case of the paddle jitters as severe as the 64's, but it's distracting enough. Also, the original routine was for one paddle only, ignoring the second paddle.

So, to keep everyone happy, we present the "Improved Paddle Reader Routine."

Two BASIC Loaders

As before, you don't have to know anything about machine language to use these routines. They are published in the form of BASIC loaders – short BASIC subprograms which you add to your own BASIC programs. Using the POKE statement, they load decimal numbers into memory which correspond to the proper machine language commands.

The VIC version is stored in the cassette buffer, an area of memory normally unused during program execution. However, a SAVE or LOAD command will use the cassette buffer, overwriting the routine. If you make this routine a part of your regular program, there should be no problem.

The 64 version is stored in a normally safe area of memory, the 88 bytes from address 679 to 710 (decimal). This is not the same area where the previous paddle reader routine was stored. The earlier routine was stored in an often-used block of memory that we've decided to preserve for other purposes.

Be sure to type in the correct version, and as always when dealing with machine language, SAVE the program before the first RUN. This allows you to recover your work in case of a typing error that crashes the computer.

Reading The Paddles

Once the routine is added to your BASIC program, it must be activated with a SYS statement each time you want to read the paddles. To start the VIC version, use SYS 828 (the beginning address of the cassette buffer where the routine resides). To start the 64 version, use SYS 679.

With either version, you then read the paddles with a simple PEEK statement. To get the averaged reading of paddle 1, use PEEK(251); for paddle 2, use PEEK(252). Here's an example on the VIC:

```
100 SYS 828:P1 = PEEK(251):P2 = PEEK(252)
```

Here's an example on the 64:

```
100 SYS 679:P1 = PEEK(251):P2 = PEEK(252)
```

Note that these locations are different from the usual paddle locations. That's because the routine stores the averaged readings at 251 and 252, not at the customary locations (i.e., 54297 on the Commodore 64).

See program listings on page 155.

How To Use Tape And Disk Files

Richard Mansfield, Senior Editor

After a few weeks with their computers, many people find themselves trying (and failing) to make *files* on tape or disk. Files are quite useful, even necessary in many kinds of programs, but you do have to be a bit patient with them at first. They're not as immediately obvious as other aspects of BASIC.

We'll take it step by step, and you'll soon have files going in and out of the computer like a pro. But before getting down to specifics, a brief historical note will demonstrate that any confusion you might have experienced when working with files is fully justified and puts you in good company. In the early days, files mystified nearly everyone.

Charming, But Slim

In 1978, the first true consumer computers – the venerable model 2001 Commodore PETs – were shipped with a charming, but slim, user's manual. This booklet, 49 pages long, was called *An Introduction To Your New PET (Revised)*. It included instructions on using the reverse field key, the cursor controls, and some elementary BASIC, along with tips on how to clean the PET. Nothing about files.

Also, there were very few books or magazines about personal computers at that time. And they said nothing useful about files either. The best sources of specific information were the few mimeographed user group newsletters. These early publications were full of techniques and debates about how to make files work.

To get a firm grip on OPEN, CLOSE, PRINT# and INPUT# (BASIC's file-handling words), the first thing we should do is clearly understand the general differences between programs and files.

Telling Them Apart

Tapes or disks can store two entirely different things – *programs* and *files*. (Don't be confused if you should read something like this in a book: "Store your program files on tape." That terminology is both redundant and confusing. There is a crucial distinction to be made between programs and files.)

A BASIC program is a collection of lines, and each line contains instructions to the computer. These instructions are to be carried out during a RUN of the program. That is, the instructions are followed in order, from the lowest line number to the highest, after you type the word RUN. A data file, by contrast, is raw information, like a page in a telephone book, without any instructions about what to do with that information.

When programs are SAVEd onto a disk or tape, they can later be LOADed back into the computer to be RUN any time in the future. Programs you type into the computer will stay there only as long as the computer is turned on. So, to build a library of programs, you must SAVE them on tape or disk. (Let's refer to tape or disk storage as *magnetic memory* from here on.)

When programs are SAVEd to magnetic memory, it's as if the tape or disk were given a photo of the program that was in the computer at the time of the SAVE. BASIC keeps track of how large a program is – where it starts and ends in the computer's memory cells – so it knows just what to "photograph" when you ask for a SAVE.

BASIC doesn't help you out this way with your files; BASIC doesn't thoroughly supervise file storage and recall. You must do several things to create a file on magnetic memory and several things to get it back into the computer later. You establish the size of the file, the divisions between items in the file (called *delimiters*), and the order of the items. We'll illustrate this in a minute, but first let's visualize how programs and files differ:

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1. Open carefully.
2. Empty contents into pan.
3. Add one can of water.
4. Heat to a simmer.

Steps one through four are clearly a program of sorts. One clue that these steps are program-like is that each item starts with a number, indicating the order in which the operations are to be performed. The ingredients – standing by themselves as raw data – are a file. And, just as the ingredients "file" in the example above is *acted upon* by the cooking instructions program, a computer program acts upon a data file.

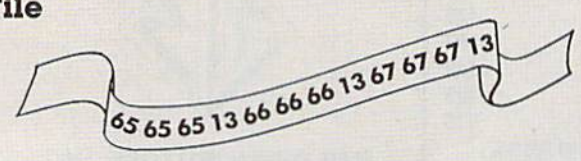
Here's a simple program which will create a tape file (there's a different format if you want to make a disk file: you change the device number in line 20 by typing OPEN 1,8,8,"0:FILE,S,W" – we'll get to the reason for the "0:" and the "S,W" later):

```
10 DATA AAA,BBB,CCC
20 OPEN 1,1,1,"FILE"
30 FOR I=1 TO 3
40 READ D$
50 PRINT#1,D$
60 NEXT I
70 CLOSE 1
```

PRINT# (usually pronounced "print-number") is an entirely different command from PRINT, and the punctuation, as always in programming, must be exact. Line 40 is interesting because we keep READing D$ over and over to use it as a temporary holding place until we can PRINT# to a magnetic memory. D$ isn't anything in itself (it varies, it's a *variable*). READ will pick out each datum from the DATA in line 10 in turn, keeping track of the last one that was READ.

In any case, after this program is RUN, the magnetic memory would contain a file. If we could look at that file on the tape the way we would look at a photograph, we would see a row of numbers. The number 65 stands for the letter A, and 13 represents a carriage return. Here's what the photograph would look like:

A Strip Of Tape Containing Our Example File



A *data base manager* is a program that manipulates data in files. Writing a large, flexible data base managing program is not a simple task – it can involve sorting, searching, and other complex programming techniques. Nonetheless, handling Christmas card lists is not beyond beginning programming skills. Files do, though, represent something of a challenge. Your computer's manual contains information on the necessary punctuation and syntax for the BASIC commands which manipulate files. However, a brief overview might be of help.

OPEN, PRINT#, INPUT#, And CLOSE

While a program would be stored by the simple SAVE instruction, a file is stored by a combination of OPEN, PRINT#, and CLOSE. Likewise, a program is just LOADed, but a file is "loaded" into the computer with OPEN, INPUT#, and CLOSE. Files *are* a bit more complicated, but the trade-off is that you can do more manipulating with files, easier *appending* (adding to them), easier *merging* (making two files into one), and so on.

The command OPEN is generally used to communicate with a disk or tape drive. It's like pulling open a file cabinet drawer – once a file is OPENed, you can then get at the records inside. Here's what you would do to OPEN the file we created earlier. This time, instead of writing to it, we'll read from it.

OPENing Commodore Files

```
10 OPEN 1,8,8,"0:FILE,S,R"
```

The first number (1) means that this OPEN will hereafter be called #1. When you pull something out of it, you would use INPUT#1 (you can keep open up to ten files at one time). The second number (8) means disk drive (a 1 in this position would mean to open a file on the cassette drive). The second 8 is a secondary address which allows you to give additional instructions. With disk drives, just use 8.

The 0: specifies drive zero and the S means *sequential* file. The Commodore disks can create two other kinds of files: random and relative, but sequential is the simplest. Finally, the R means *read*, so you will be using INPUT# to get things out of this file. (A W here would mean *write*, and you would PRINT# to the file.) To make this "reading or writing" distinction for tape files, the secondary address is used: a 1 means write and a 0 means read. (10 OPEN 1,1,0,"FILE" would be the same as the example above, except it's for a cassette file. No drive number is specified, and the S is not necessary since cassette files can only be sequential files.)

Taking Something Out

Recall that we put things into a file with PRINT#. Going the other way, you get something out of an

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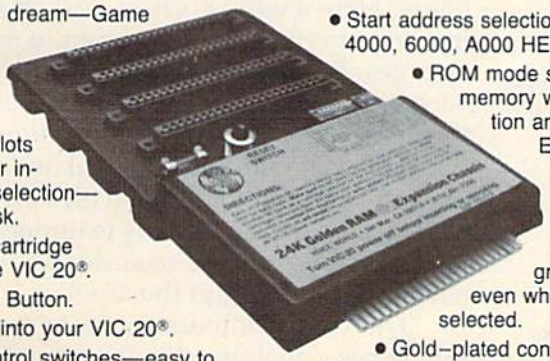

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OPENed file by using INPUT# in combination with a string variable to "hold" whatever comes from the file (they come back to the computer in the order they were PRINT#ed in a sequential file). To get the AAA back:

```
20 INPUT#1,A$
```

Then you could print A$ to see the data AAA it holds:

```
30 PRINT A$
```

To get the rest of the data we stored, you could:

```
40 INPUT#1,B$:PRINT B$
50 INPUT#1,C$:PRINT C$
```

After you are finished INPUT#ing or PRINT#ing from a file which had been OPENed as file #1, you would close it:

```
60 CLOSE 1
```

When you've finally CLOSEd the file, you are free to use that file number (#1 in these examples) for some other file, with a different name. CLOSE is essential, however. Without it you could permanently lose part or all of a file, or even damage other files. Don't leave files open after you're finished with them.

INPUT# And PRINT# Hints

The INPUT# and PRINT# work very similarly to the way INPUT and PRINT work from the keyboard and to the screen. The only catch is that PRINT# needs some special handling. It's best to give it a line all to itself:

```
20 PRINT#1,A$
30 PRINT#1,B$
```

The reason for putting PRINT# on its own line is that this is an easy way to separate items in a file: with carriage returns. Just as:

```
20 PRINT A$
30 PRINT B$
```

causes B$ to be on the line below A$ on the screen (since using a new line forces a carriage return to take place) – a separate program line puts a carriage return symbol onto the tape or disk and keeps the data from running into each other. This kind of "separator" symbol is called a *delimiter*.

Manipulating Files

Our example program above, which reads data from magnetic memory into the computer, does work, but it's cumbersome. Files are usually written to or read from within loops. Here's a simple program to write a file to tape:

```
10 DATA BILL, SANDY, KATIE, LARRY
20 OPEN 1,1,1,"NAMES":REM (A TAPE FILE)
25 PRINT#1,4
30 FOR I=1 TO 4
40 READ A$
50 PRINT#1,A$
60 NEXT I
70 CLOSE 1
```

Since there are four names in this file, the loop counts up to four, READing a new A$ from the DATA line each time through. Since PRINT#1 is by itself on line 50, it will send carriage returns to the tape each time it PRINT#s, separating the names on tape with delimiters. This way, there will be no question of something like BILLSANDY being stored.

When this file is later read into the computer, it would be very useful to know when the entire file ends, how big it is. There are two ways to do this. You could add the word "END" to the DATA line and then change line 30 to read: FOR I=1 TO 5. Or, you could put the *count* (the number of records for this file) on the tape or disk itself, as part of the file. See line 25 above for an example of this.

Here's a "reader" program which first pulls the count out of the file and then brings the records into the computer:

```
10 OPEN 1,1,0,"NAMES":REM (A TAPE FILE)
20 INPUT#1,COUNT:REM THIS IS THE FIRST IT
   EM ON THE FILE
30 FOR I=1 TO COUNT
40 INPUT#1,A$
50 PRINT A$:REM (TO THE SCREEN)
60 NEXT I
70 CLOSE 1
```

If you use the "END" technique, the reader program would not use line 20 and would add line: 45 IF A$="END" THEN GOTO 70. If you plan to do significant manipulations with the file data, you might want to call the items into an array so that they can be worked with easily.

One final note about something which might not be immediately obvious: if you update a file, you cannot put it back on a disk using the same name. Here's why: it's first read off the disk and into memory because you want to make some changes. Before you OPEN-PRINT#-CLOSE it back onto the disk, you must first *scratch* (remove) the original file (it's in the computer now) so you can replace it with the updated one. For obvious reasons, you can't have two files on disk with the same name. This *scratching* is unnecessary for tape files, because the recorder will write over the old file (if you rewind the tape).

There are numerous ways to manipulate files. We've been dealing with *sequential* files, the most straightforward type of files; using INPUT#, the most straightforward access command; and delimiting with carriage returns, the simplest punctuation. Your manual contains information about more complex, sophisticated filing techniques, including special types of disk files, using GET#, and delimiting with commas or even using semicolons between items.

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HORIZONS: 64

CHARLES BRANNON
PROGRAM EDITOR

COMPUTE!'s Gazette introduces a new feature this issue – "Horizons: 64," a monthly column exclusively for Commodore 64 users. "Horizons: 64" replaces our previous Commodore 64 column, "64 Explorer," which is moving to our companion magazine, COMPUTE!. Our new columnist is Charles Brannon, Program Editor. Brannon's experience with Commodore computers dates back to the early days of the Commodore PET.

Commodore 64 Video – The Saga Continues

In the July issue of COMPUTE!'s Gazette, we brought you some of the latest information on Commodore 64 video. The article, "Commodore 64 Video Update," covered radio frequency interference, "sparkle," and revisions to the VIC-II chip (which is responsible for 64 video). It seems the story isn't finished, however.

Suppressing Sparkle

"Sparkle" appears on most early-model 64s to varying degrees, and even plagues some current owners. Sparkle appears as tiny flickering specks within screen characters, closely resembling TV "snow." Besides the obvious annoyance, sparkle can interfere with sprites (animated screen objects). When a sprite "bumps into" the transient flickers, the VIC-II chip thinks a collision has occurred with another screen object. In a game program, this can unjustly "zap" your spaceship. Worse, sometimes sparkle is invisible, and who's going to believe you collided with something invisible?

If you're a programmer, it's a relatively simple matter to avoid sparkle: just relocate the character set. Moving the character set out of the default area removes the conflict that causes sparkle. Many games use a custom character set anyway, so in practice you may not encounter many problems.

If you're not a programmer, you may be able to reduce sparkle by simply switching to lowercase. In most 64s, either the uppercase or lowercase character set has more sparkle than the other. Just press both SHIFT and the Commodore logo key simultaneously to switch. If you're playing a game that uses graphics characters (most of which are not available in lowercase), then this is obviously not a good solution.

The New 64s

The latest Commodore 64s (and VIC-20s too) have changed quite a bit. Video quality is much improved. RF interference (which distorts the TV image) is almost gone, due to added shielding (aluminized cardboard covers the circuit board, and there is a metal plate underneath). The characters seem crisper, the colors brighter.

If you opened the case of the 64 (not recommended; it will void your warranty), you would find that the number of chips has been reduced dramatically. This makes the machine run cooler, but more important, it cuts Commodore's costs. This is a major reason why Commodore can continue selling 64s for under $200, from a previous high of $595. And the price may continue to drop. A price tag of $100 may not be as radical as it seems. Strangely, though, this may not happen simply because Commodore now has less competition in the under-$200 price range. Few competing machines at that price can boast the standard 64K of memory.

Other Changes

The latest 64s incorporate two other changes – the five-pin audio/video socket now has eight pins, the power supply is larger (some components inside the 64 were moved to the power supply, making the computer run cooler), and the power plug has only three pins, although the socket has room for seven. On previous 64s, it was possible to mistakenly plug the power cord into the audio/video socket (a tragic mistake), since both are five-pin sockets. On the latest 64s, it is impossible. According to sources at Commodore, however, there are no extra functions assigned to the additional pins on the audio/video plug, and the standard five-pin cables still work just fine.

How Computer Video Works

There is a way, however, to take best advantage of the 64's video output – attach it to a monitor. The price of quality color monitors has been dropping of late. Video monitors have the same picture tube as any high-quality television. TV

sets, of course, are designed to pick up only broadcast signals. To feed the 64's *composite video* signal into your set, it must be converted into a TV signal. In effect, you have a tiny television transmitting-station inside your 64 (the RF modulator). If the signal was much stronger, you wouldn't even have to make a physical connection. You (and your neighbors) would pick it up like any broadcast.

And there's the problem – the 64 has to convert its "pure" video signal into broadcast signals, which are fed into the TV's antenna through the switch box (which really doesn't do anything to the signal). The TV converts the signals with its tuner, and then controls the red, green, and blue electron guns that continually "paint" the TV image on the inside of your TV tube.

The tuner is susceptible to much interference, both from local stations, and stray signals from the computer (the tiny silicon switches within the chips work so fast, they generate a field with the same cycle rate as radio signals). You also lose clarity in the translation process. It's like recording a tape by placing the tape recorder near your stereo speakers. You get a much better recording by plugging your tape recorder directly into your stereo's output.

That's what the five-pin audio/video plug is for. Video monitors can accept the composite video signal directly, without having to go through a tuner. Without a tuner, the TV can't pick up any interference, and it doesn't have to translate the signal. The monitor then breaks down the composite video signal to control the electron guns.

There are two separate video outputs: chrominance and luminance. Luminance controls the brightness or darkness of a screen. It provides contrast. You can attach a monochrome (non-color) monitor with the luminance signal. Most color monitors use the composite video signal (which has a little luminance mixed in with it).

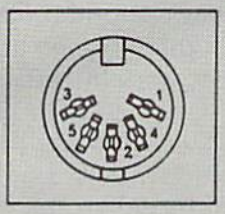
The Commodore 1701 Video Monitor

Thanks to a special deal with a Japanese TV manufacturer, Commodore is able to market an affordable alternative to TV sets and expensive color monitors. Discounted to under $300, the Commodore 1701 Video Monitor has two connections, front and rear. The front connection is like any monitor, accepting composite video and audio (incidentally, the sound is excellent, with a decent-sized speaker). The rear connection, though, is special: there is circuitry to mix in the separate luminance signal.

The result? Phenomenal. There really is no parallel. All the problems the 64 has suffered with "color smearing" and bad contrast are solved. Almost any color combination looks great. It won't fix sparkle, however (sparkle is a problem with the computer, not the video display).

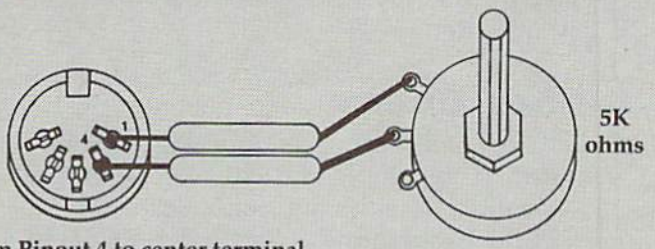
Many people who already own the video monitor don't know how to use the rear connection, since the monitor is packaged with a cable for the front connections (for the VIC's sake). If you're handy with a soldering iron, you can make your own cable, using Figure 1. You can also obtain an "octopus cable" which has the five-pin plug on one end and four RCA jacks on the other (like stereo connectors). The color scheme varies; you can't hurt your equipment if you try hooking up the four plugs by trial and error. Remember to flip the switch behind the monitor which selects the rear hookup. With the cables we've used (generically called an "audio/video cable"), the black plug goes into Audio, the white into Chroma, and the red into Luminance.

Figure 1: Audio/Video Pinout (Rear of 64)



Pin 1: Luminance
Pin 2: Ground
Pin 3: Audio Out
Pin 4: Video Out
Pin 5: Audio In

Figure 2: Improved TV Connection:



From Pinout 4 to center terminal.
From Pinout 1 to any other.

Super TV

If you're using your 64 with a TV, you're in for a treat, too. If you can make your own cable, or can find someone who can do it for you, you can improve the 64's picture on your set (although it won't improve ordinary TV reception). It involves mixing a little luminance into the color signal to improve contrast. The simplest technique is to just attach a wire (or paper clip!) between pin-sockets 1 and 4 on the back of your 64 (see Figure 1). Unfortunately, this is too much for the ordinary TV set. It "overdrives," and you get an extremely bright, distorted picture. Some sets work just fine, though, after you've adjusted the color and

contrast. However, the overly strong video signal "drowns out" the computer's sound.

A better way is to reduce the amount of luminance you mix in. This is done by putting a potentiometer (variable resistor) between pins 1 and 4. If you twist the wires tightly, you don't even have to solder. Commodore recommends using a 5K potentiometer. The dealer at your local electronics parts store (such as Radio Shack) can help you find one. See Figure 2. Once you've hooked it up, you can turn the knob on the potentiometer to adjust how much luminance you want. Most people agree that the resulting picture is far better.

Odds And Ends

This handy tip comes from Programming Assistant Eric Brandon: if you would like to fill color memory on current model 64s with any color almost instantly, set the background color (POKE 53281) to the color you want to fill with, then clear the screen. The clear screen routine does the job. You can then set the background color to some contrasting color. Thereafter, POKEs to screen memory don't require the corresponding POKE to color memory. If you've been doing this already (older 64s always fill color memory with white), insert the extra code so the program will work on everyone else's 64.

For example, to fill color memory with white:

```
POKE 53281,1:PRINT CHR$(147);:POKE 53281,6
```

It has come to our attention, though, that Commodore has made yet another revision to the Kernal ROM (the operating system). As mentioned, Revision 1 always filled color memory with white when the screen is cleared. In Revision 2, color memory was filled with the background color (to deprive sparkle of its color). Finally, Revision 3 fills color memory with the color of the cursor (set with CTRL 1-8 or COMMODORE key 1-8). Both Revisions 1 and 3 will allow POKEs to screen memory without the corresponding POKE to color memory, since color memory is set to a color which contrasts with the background color. To be safe, and allow your software to run on all 64s, you may want to fill color memory by setting both the background color and cursor color to white, clearing the screen, and then resetting the background color to whatever you want to use.

Be sure to tune in next month. We've got quite a few interesting topics in mind. In future columns, we'll briefly review significant new hardware and software for the 64. This way, you'll find out about these products faster than the time it takes to do an in-depth review (which usually follows). If there's anything you'd like us to discuss, or if you notice any interesting hardware or software products, write us.

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DAN CARMICHAEL, ASSISTANT EDITOR

Keeping Time With The VIC

The Commodore VIC-20 has a realtime clock. In this month's column, we'll show you how to program it to do everything from simply telling the time to creating timers for games.

The Jiffy Clock

The realtime clock that is standard with all VIC-20s can be a very useful tool for games, programs, etc. The clock, which occupies three memory locations, is called a *jiffy clock* and is located at bytes 160 through 162.

Before we talk further, let's take a look at the jiffy clock while it's running. Enter, then RUN the following short machine language program. We'll use machine language here so we can see the clock running at just about its real speed. The program will display the three jiffy clock bytes (162, 161, 160) in the center of your screen. To stop the clock, press RUN/STOP-RESTORE.

```
1 FORA=828TO846:READB:POKEA,B:NEXT
10 PRINT"{CLR}":TI$="000000":POKE38628,6:
   POKE38630,6:POKE38632,6
20 SYS828
828 DATA 165,162,141,228,30,165,161,141,2
    30,30
838 DATA 165,160,141,232,30,76,60,3,234
```

What you are seeing displayed is not actually the numbers running by in the clock, but the screen POKE values of the numbers. For example, the screen POKE value of @ is 0, the value of A is 1, etc.

As you can see, the clock runs very fast, and the speed is not the same as for a standard clock (one "click" every second). The first byte you see displayed (the byte moving the fastest) is byte 162 – the low-order byte of the jiffy clock. This byte is actually counting from 0 to 255 by ones. It does this in 4.266666 seconds. That is, it takes 4.266666 seconds for it to count 1,2,3,...255, then back to zero to start the cycle again. It increments, or counts, 60 times every second. That's why it's called a jiffy clock – a "jiffy" is 1/60 of a second.

The VIC performs a number of operations at this speed. For instance, 60 times every second it checks the keyboard to see if any keys have been pressed and updates the keyboard buffer if necessary. It also takes care of the cursor blinking routine.

The jiffy clock is like a simple three-digit counter. Each time byte 162 goes through its cycle and returns to 0, it "clicks" or increments the next byte (byte 161) by one. And every time byte 161 runs through its 0 to 255 cycle, it increments the next byte (160).

Telling Time With The VIC

The VIC's TI$ and TI (*time*) functions are translations of the jiffy clock. TI$ and TI are built into the BASIC that is in both the VIC-20 and the Commodore 64. The TI$ function returns a six-character string in the same format as a standard clock: hours, minutes, seconds. The TI function returns a value in tenths of seconds.

For a demonstration of these two functions, enter and run (separately) the two following short programs. When you enter the first demonstration

program (TI$), enter the current time in the format *HHMMSS*, where *HH* = hours, *MM* = minutes, and *SS* = seconds. For example, to enter the time 3:30 a.m., enter "033000".

The second demonstration program emulates a stopwatch. Press F1 to start, F3 to stop and display elapsed time.

TI$ Demo

```
10 PRINT"{CLR}{DOWN}ENTER CURRENT TIME":P
   RINT"IN FORMAT: HHMMSS":INPUTTI$:PRINT
   "{5 DOWN}"
20 PRINT"{8 RIGHT}";TI$"{UP}":GOTO20
```

TI Demo

```
10 PRINT"{CLR}{4 RIGHT}VIC STOPWATCH":PRI
   NT"{DOWN}PRESS F1 TO START":PRINT"PRES
   S F2 TO STOP{2 DOWN}"
20 GETA$:IFA$="{F1}"THENTI$="000000":PRIN
   T"{2 DOWN}TIME IN SECONDS ={DOWN}":GOT
   O40
30 GOTO20
40 PRINT"{2 RIGHT}";TI/60"{UP}"
50 GETA$:IFA$="{F3}"THEN70
60 GOTO40
70 PRINT"{6 DOWN}PRESS A KEY TO REPEAT"
80 GETA$:IFA$=""THEN80
90 GOTO10
```

As you can see, when you use the VIC's TI$ and TI functions, the jiffy clock is automatically converted into a realtime clock. We'll be using TI$ and TI to create a nice clock display and to discuss the creation of timers for games. By the way, the time format the TI$ function returns is that of a 24-hour clock. It's like military time, where 1400 hours would be 2:00 p.m. With the use of an IF/THEN statement or two, you can turn it into a standard 12-hour (a.m. – p.m.) clock.

Clocks And Timers

Enter the following program and RUN. The program will turn your VIC-20 into a colorful clock with sound. The program is very simple in that it does only two things: it POKEs or PRINTs colors to the screen, and it displays the time. The colors that are POKEd to the screen while the program is running are done with machine language. It could have been done with BASIC, but it would run much slower. If you would like to change the speed of the color as it is POKEd to the screen, change variable SP in line 1 of the program, then RUN.

Program 1: Color Clock

```
1 POKE52,28:POKE56,28:CLR:SP=12:GOTO10
2 C=INT(RND(1)*N)+0:IFC=1THEN2
3 RETURN
10 GOSUB300:PRINT"{CLR}":SC=7680:CO=38400
   :POKE36879,25:N=8:O=160:Q=505:POKE7195
   ,SP
20 IF4*(PEEK(36866)AND128)+64*(PEEK(36869
   )AND112)=4096THENSC=4096:CO=37888
40 FORA=0TOQ:GOSUB2:IFA=226ORA=248ORA=270
   THENA=A+10
50 POKESC+A,O:POKECO+A,C:NEXT:PRINT"{BLK}
   {9 DOWN}"
60 SYS7168:PRINTTAB(7)LEFT$(TI$,2);":";MI
   D$(TI$,3,2);":";RIGHT$(TI$,2);"{UP}":G
   OTO60
300 FORA=7168TO7199:READB:POKEA,B:NEXT
305 PRINT"{CLR}{DOWN} ENTER TIME IN FORMA
    T:":PRINT"{DOWN} HHMMSS"
310 PRINT"{2 DOWN} WHERE HH=HOURS":PRINTT
    AB(7)"MM=MINUTES":PRINTTAB(7)"SS=SECO
    NDS"
320 INPUTTI$:RETURN
7168 DATA 160,0,174,104,144,173,105,144
7176 DATA 157,0,150,157,0,151,169,0
7184 DATA 170,157,249,150,232,224,9,208
7192 DATA 248,200,192,12,208,228,96,234
```

You might also want to study line 60 of the program. Using the LEFT$, MID$, and RIGHT$ commands to manipulate strings (used here to separate the hours, minutes, and seconds in the jiffy clock) can be a very useful programming technique, and is well worth learning.

This clock program could also be turned into an alarm clock with one easy IF/THEN. For instance:

```
10 IF TI$="XXXXXX" THEN POKE 36878,15:
   POKE 36876,200
```

"XXXXXX" here represents the time, in hours, minutes, and seconds, when you wish the alarm clock to ring.

Using the jiffy clock to create a "countdown timer," as is often found in games, is actually very easy. Because the jiffy clock is able to count or run forward only, it cannot be directly programmed to count down. However, you can program a countdown timer by subtracting the values of the clock from a constant (a number value that doesn't change), then using the difference as your counter. For example, enter this program and RUN.

Program 2:
Countdown Timer – Whole Seconds

```
1 PRINT"{CLR}{2 DOWN}"
10 TI$="000000":A=30
20 PRINT"COUNTDOWN TO 0:"TAB(15)A-VAL(TI$
   );"{LEFT} {UP}"
30 IFA-VAL(TI$)<=0THEN50
40 GOTO20
50 PRINT"{2 DOWN} TIME EXPIRED!!!"
```

Here we set the jiffy clock to zero (line 10, TI$ = "000000"). Then the variable A (which represents a constant value of 30) is subtracted from the value of the clock (VAL (TI$)). As the clock value gets larger, the difference in subtraction gets smaller, causing the countdown effect. You can change the variable A in line 10 to create a timer of any value you wish. Because this timer uses the TI$ variable as the subtrahend, it will

decrement by a value of whole seconds.

If you wish to create a countdown timer that will work with values in fractions of seconds, you can use the same programming technique with the TI function. Remember that to get a proper time display, TI must always be divided by 60 (TI / 60). Enter and RUN this program:

Program 3:
Countdown Timer — Fractions Of Seconds

```
1 PRINT"{CLR}{2 DOWN}"
10 TI$="000000":A=30
20 PRINT"COUNTDOWN TO 0:{2 DOWN}"
25 PRINTTAB(5)A-TI/60;"{LEFT} {UP}"
30 IFA-TI/60<=0THEN50
40 GOTO25
50 PRINT"{2 DOWN} TIME EXPIRED!!!"
```

Here, the technique is the same, except that TI was used as the subtrahend instead of TI$, which returned a difference in fractions. In this program you can also change the variable A to any value you wish.

The built-in jiffy clock can be a very useful programming tool. You can program it to do everything from simple tasks like ringing an alarm when your favorite TV program is on to adding timers to your favorite games for added excitement and challenge.

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Understanding Sound On The Commodore 64

Part 1

Gregg Peele, Programming Assistant

This series will explore the Commodore 64's versatile sound features – the best found on any home computer. This month, there's a utility program which makes it much easier to design sounds on the 64 and add them to your own programs. The author, an editorial programmer for COMPUTE!'s Gazette, also is a graduate student in music.

In the premiere issue of COMPUTE!'s Gazette ("Enlivening Programs With Sound"), I wrote of the many fascinating uses for sound effects in programs. Delving even deeper into the subject, let's now discuss the special sound features of the Commodore 64 and the ways you can use these features in your own BASIC programs.

The Amazing SID Chip

The Commodore 64 has three independent *voices* (sound channels), each having one of four possible *waveforms* (tone colors). These voices, produced by the MOS 6581 SID (Sound Interface Device) chip, can be set up to simulate almost any sound. In fact, the capability of the SID chip has been compared to music synthesizers costing more than the entire Commodore 64. To understand how to use the SID chip effectively, a brief discussion of the nature of sound is necessary.

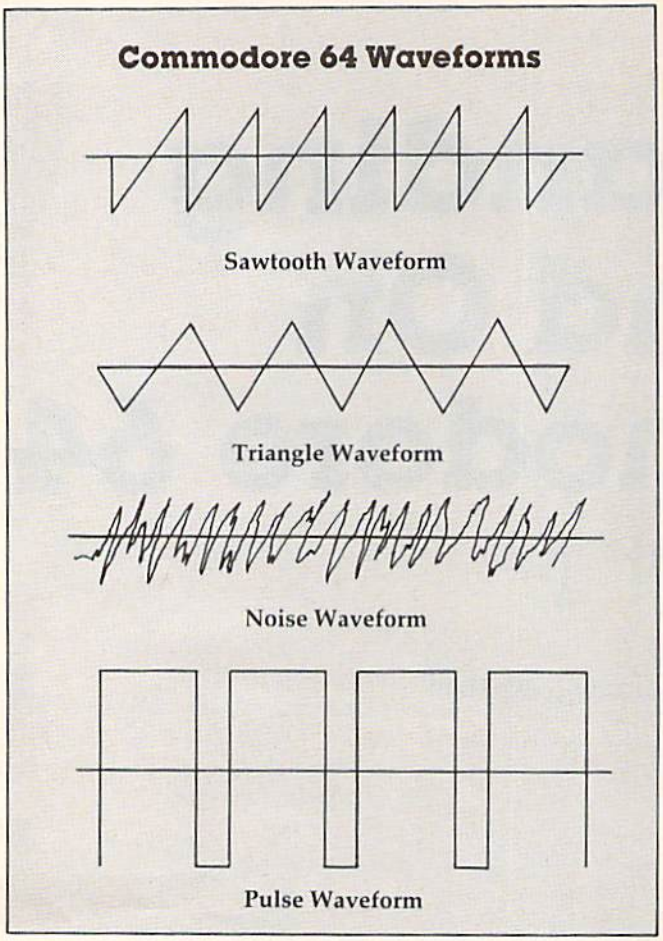
Some Sound Theory

Most sounds in music and many sounds in nature have a defined *pitch*. Pitch is a way of describing how "high" or "low" a particular sound is.

The SID chip has a pitch range of nine octaves. This is about two octaves greater than a piano. When programming, these pitch values are formed from two *bytes* (a byte is a memory location which can hold a value of 0 to 255). This yields a range of more than 65,000 (256 x 256) possibilities of different pitch values for notes. The *pulse* waveform, one of the four waveforms available, allows an even broader range of pitch values.

Waveforms

Since we've already mentioned waveforms a couple of times, maybe we should clarify exactly what a waveform is. Almost every sound consists of a pulsating motion generally referred to as vibration. Different materials vibrate in different patterns. This is one reason why the different instruments of the orchestra have unique tonal qualities. The SID chip is able to produce four different waveforms: triangle, sawtooth, pulse, and noise (see the figure). Each of these waveforms produces a unique sound and, along with pitch and envelope control, form the basis for sound synthesis on the Commodore 64.



A Stone's Throw

Sound waves, like waves from a stone thrown into a pond, constantly change. In fact, much of our ability to discern one sound from another is because of the unique pattern of change which "fingerprints" each sound. Some familiar examples are the different sounds produced when you strike something with a metal or rubber hammer. Much of the sound produced by the rubber hammer is absorbed within the hammer itself.

Envelopes

Most sounds follow a similar pattern through time. This pattern is the *envelope* (see photo of Program 1). First, the initial event which creates the sound sends the volume level rapidly upward. This section of the envelope, called the *attack*, may be the major defining factor of a sound. A hand clap consists almost entirely of the attack section.

After this initial attack, the volume level decreases during the *decay* section. After this decrease, the volume level stabilizes for a time in what is called the *sustain* section. The sound then begins its final descent which terminates in silence. This descent is the *release* portion of the sound.

The combination of attack, decay, sustain, and release is the envelope, sometimes called the ADSR envelope. The SID chip provides a means to define the way a sound changes through time. This change is controlled with an *envelope generator*. The attack and decay sections are controlled within one byte – each using four bits (there are eight binary digits, or bits, in each byte). The values within this byte determine the rate that the volume changes through time. A low value for attack or decay indicates a short duration for that particular section. A larger value increases the duration of a particular section.

The sustain and release portions of the envelope also share one byte. However, sustain does not relate to a time value but to a volume level. The release section, like attack and decay, refers to a rate of change, and values for this section change the amount of time allocated for this change to occur.

Admittedly, all of this is not easy to understand at first. If you type in and run Program 1, you'll see and hear an animated demonstration of the ADSR envelope.

All Together Now

Producing sounds with the SID chip requires that certain *registers* (memory locations) within the chip contain values which represent the waveform, volume, and ADSR envelope. Also, there must be some provision for setting the length of the note. POKE commands in BASIC are used to place values for waveform, volume, and ADSR into their appropriate places.

The length of the sound is determined by using two BASIC FOR/NEXT loops as timers. The larger the value for the loops, the longer the length of the particular portion of the sound. The first loop determines the length of time allotted for the sustain portion of the sound, and the second loop determines the length of time allotted for the decay portion. The waveform byte turns the sound on. When turned off, it begins the decay, which ends the sound. One bit of that byte, referred to as the *gate bit*, is reserved for that purpose.

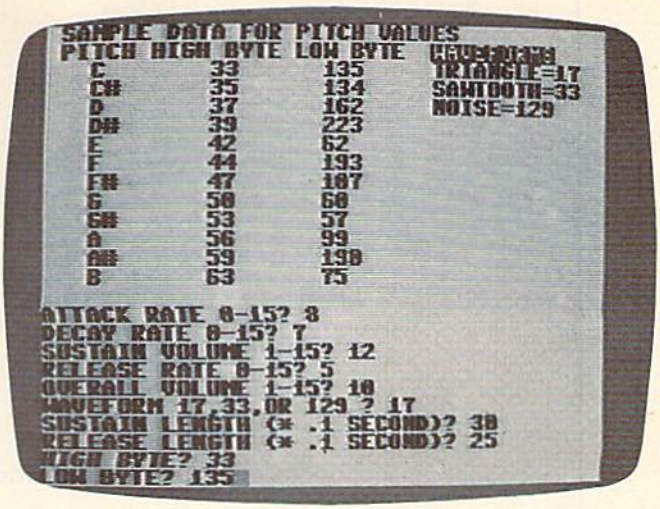
Here is the sequence of events: first the values for volume and ADSR are put in their proper places using the POKE command. Next, you turn on the sound by turning on the waveform byte with the gate bit set to 1. (This byte will always contain an odd value since the gate bit is the lowest bit in the byte.) Our FOR/NEXT loop is now used to provide a delay, which runs while the attack, decay, and sustain sections execute. When this loop finishes, we then replace the value that was in the waveform byte with an equivalent value minus one. This resets the gate bit and signals the release section to begin. The volume decreases until the sound is finally silent. Another FOR/NEXT loop allows the release section adequate time to execute.

An Example Program

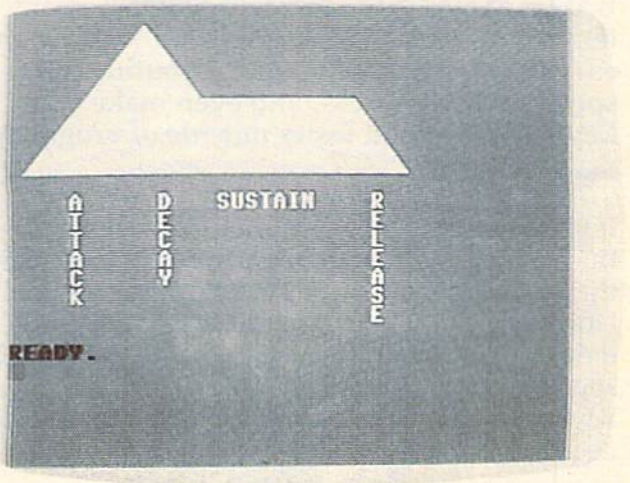
Does all of this sound hopelessly complicated? To best illustrate the waveforms, pitches, and the envelope generator, I have included a program that allows you to manipulate all the parameters mentioned and actually create your own sound routine for use in other programs. To use Program 2, merely enter the values for volume, waveform, ADSR (attack, decay, sustain, release), and values for the length of the sustain and release. (Remember, within the range of values given, the lower values represent either low volumes or shorter lengths of time for each section.)

You also must enter two values to define the pitch of the tone. These pitch values can be derived from the table of values displayed on the screen or from the tables in the *Commodore 64 Programmer's Reference Guide* (pages 384-86).

When you are prompted with the word "Again?", press "N" if you are pleased with the sound that you have produced, or "Y" if you wish to continue altering the sound. If you press "N", a subroutine will be created that you can add to your own programs. You will be prompted for the starting line number and the increment that you wish to leave between lines for the subroutine.



Program 1 visually and audibly demonstrates the "ADSR envelope" of a sound.



Program 2 makes it easier to experiment with sounds on the 64, and lets you add sounds to your own programs.

Then your finished sound routine will appear on the screen. (Before you type "N", make sure you have saved the original program, because it will be erased.) You may now use this new sound routine in any program or save it on disk or tape for future use.

One Small Step

We have taken only the first step toward understanding the complexities and possibilities of the SID chip. The program uses only one of the Commodore 64's three voices, and we have yet to discuss some advanced applications of the SID chip's features. However, we have taken a large step in our quest to uncover the mechanics of sound synthesis on the Commodore 64.

See program listings on page 154.

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Speeding Up The VIC

Dan Carmichael, Assistant Editor

One animation technique frequently used in BASIC games is to repeatedly PRINT characters on the screen. This article shows how an easy-to-use machine language routine can speed up this process, and even make your keyboard respond faster *outside* of programs.

If you're writing games or programs which use the keyboard to move objects around the screen, the lack of speed may be your biggest complaint. However, if you're using the GET statement to move things about, there are ways to increase the speed greatly. This is done by manipulating the keyboard "controls" within the VIC-20 computer itself.

Keyboard Controls – How They Work

First, to make sure your VIC is set normally for this demonstration, you might want to turn it off and then on again to clear it.

Press the space bar, and continue to hold it down. The cursor will keep moving across the screen because the *operating system* – a control program inside the computer – tells the VIC to continue repeating this process, even though you pressed the space bar only once. Now press any alphabetical key, and continue to hold it down. We'll use the A key here (and from now on) for ease of reference. Even though you continue to hold it down, the A will not repeat itself. This is because the only keys that the VIC is programmed to repeat are the space bar, INSERT/DELETE, and the two cursor control keys.

Clear the screen by pressing SHIFT-CLR/HOME, and then enter POKE 650,128. Memory location 650 tells the operating system which keys to repeat. Normally it is set to 0, which allows only the aforementioned keys to repeat. A value of 128 allows all the keys to repeat. Now if you press the A, it will repeat as the space bar did. Leave location 650 POKEd to 128 for now.

Speeding Up The Repeat

Press and hold the A key a few times, and notice that there is a pause of a fraction of a second before it starts to repeat. This pause is controlled by memory location 652, which is a *counter*. When you press the A key, this location contains a 15. Then it counts backward, in steps of ones, until it reaches 0, which signals the computer to begin the repeat process.

To shorten the pause, you might think you could simply POKE a number less than 15 into location 652. But because of the way the VIC's operating system works ("sweeping" through the computer 60 times every second resetting various parameters, etc.), location 652 will quickly be changed back to 15. However, you can use a program that will keep this location permanently loaded with a 0, thus eliminating the repeat pause. Enter Program 1 – a BASIC loader that will POKE a short machine language program into the cassette buffer (an area of usable memory). Verify it carefully, then run it by entering RUN 59998. Now the machine language program is POKEd into memory and ready to run. Enter SYS828 to start the machine language program.

Now if you press the A key, you will notice that it starts repeating immediately. With location 652 constantly reset to 0, there is no "countdown," and thus no pause.

By the way, if you make a mistake while entering one of the machine language programs and are forced to turn your VIC off/on to recover, remember to rePOKE 650,128 before continuing this article.

Another location which will help you speed up your program is memory address 651. This location is also a counter, and it determines the time delay between the printing of each character when repeating. Location 651 uses the same countdown technique that 652 does, except it starts at 4 instead of 15. While repeating, it counts down to 1, prints the character, and then cycles down again. In other words, it counts "4-3-2-1-PRINT character," "4-3-2-1-PRINT character," etc.

As with location 652, you cannot shorten the time delay by POKEing a value less than 4 into location 651. The operating system "sweeps" through 651 also, and restores it to 4 every sixtieth of a second. But again, we can load a program to circumvent this problem.

Type in Program 2, which is another machine language program. This program modifies both locations (651 and 652) and speeds up the whole repeat process. Verify your typing carefully, then enter RUN 59997 to POKE the machine language program into memory. Enter SYS828 to start the machine language program. Now press the letter A, and notice how much faster it repeats. Compare this to the normal speed by pressing the RUN/STOP and RESTORE keys simultaneously (to stop the machine language program) and then pressing the A key.

Program 2 can be added to your own BASIC programs and will help speed things up for you.

However, two things should be noted about this program. First, after the initial BASIC program has been run, and the machine language program has been successfully POKEd into memory, you may delete lines 59997-59999. They are not needed. Second, because the machine language program runs in the cassette buffer, you cannot use the cassette recorder while the machine language program is running. Press RUN/STOP-RESTORE to disable the program before using the recorder.

Program 3 is optional. It is a program that uses the GET statement to move the ball character (CHR$ (81)) around the screen. It is written to utilize the machine language speed-up routine. You can either add it to your existing BASIC program or build your own BASIC program around it.

How To Use Program 3

Carefully type in Programs 2 and 3. If you wish to save memory by changing the line numbers in Program 3, you may do so, but remember to change the *corresponding* GOTOs, etc. If you want to change the character that moves around the screen, this is controlled by the variable H in line 60000.

To run the program, first enter RUN 59997 to POKE the supporting machine language routine into memory, then enter RUN 60000 to execute the BASIC program. These keys control the character's movement:

Key	Movement
W	←
R	→
P	↑
*	↓

Line 60050 is optional. Without it, the movement of the ball will increase in speed slightly, but the ball will blink, which you may or may not find desirable.

See program listings on page 155.

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HES MON ASSEMBLER (C) (VIC OR 64)	29
DUST COVER	7
QUICK BROWN FOX (C) (VIC OR 64)	54

COM-64

WORDPRO 3 + (D)	69
VIDEOPAK 80 (80 COLUMN)	159
Z-80 VIDEOPAK (WITH CPM)	259
6502 PROF. DEV. SYSTEM (T)	23
ROBBERS OF LOST TOMB (D,T)	21
LASER STRIKE (T)	22
ELEMENTARY 64 (BOOK)	14
64 FORTH (C)	46
JUMP MAN (D,T)	29
KINDERCOMP (D)	23
FORT APOCALYPSE (D,T)	26
ZORK I (D)	29
FROGGER (D,T)	26
ANNIHILATOR (T)	18
TEMPLE OF APSHAI (D,T)	29

VIC-20

16K RAM	59
CARDBOARD (3 SLOT EXP.)	33
VIDEOPAK (40/80 COLUMNS)	89
HESWRITER (C)	29
TURTLE GRAPHICS (C)	29
VIC FORTH (C)	46
CHOPLIFTER (C)	33
SHAMUS (C)	29
SCORPION (C)	29
SPIDER CITY (C)	29
SWORD OF FARGOAL (T) 21K	23
KIDS AND THE VIC (BOOK)	17
VIC GRAPHICS (BOOK)	12
NEWPORT PROSTICK	23
TYPE ATTACK (C)	29

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NEWS & PRODUCTS

Two-Keystroke Commands

Disk Support, a 1K machine language extension that adds 12 new commands to the VIC-20 or Commodore 64, is available from H & H Enterprises.

With the program, you can SAVE, SAVE WITH REPLACE, LOAD, VERIFY, DELETE, and RENAME disk files with two keystrokes. Other two-keystroke commands allow you to INITIALIZE, FORMAT, or RENAME a diskette, EXECUTE and program on the disk, print ERROR messages to the screen, and list the disk directory without affecting what's in memory.

Disk Support, which is compatible with memory expansion cartridges, works with single and dual disk drives. The program sells for $14.95.

H & H Enterprises
5056 North 41st St.
Milwaukee, WI 53209

Detective Adventure

Shamus, a well-received Atari adventure program from Synapse Software, has been licensed by Human Engineered Software for the VIC-20.

In the game, Shamus battles hordes of robot henchmen while searching a series of treacherous mazes for the keys that will lead him to the Shadow. The game, which is available on cartridge for $39.95, requires an investment of time and practice to master.

HES also is introducing *Coco 2*, a game that teaches the fundamentals of computer game design, for the 16K VIC and 64. *Coco 2*, which introduces the user to control of color, sound, weapons, and objects, as well as scoring and game speed, is available for $39.95 for the VIC version, and $44.95 for the Commodore 64 version.

Human Engineered Software
71 Park Lane
Brisbane, CA 94005

The Magic Of Numbers

Arith-Magic, an interactive math study program that has been available for the PET, TRS-80, and Apple computers, is now available in a Commodore 64 version.

The package includes three programs that help students learn mathematical theory in a game-like setting. In Diffy, students work with the differences between successive pairs of numbers. In Tripuz, students learn the identity of three numbers hidden within a triangle. And Magic Squares produces nine-element squares in which the numbers in each row, column, and diagonal add up to the same sum. In working with Magic Squares, the student develops an intuitive understanding of averages and arithmetic sequences.

Arith-Magic, produced by Quality Educational Designs, is available on tape and disk for $35.

Quality Educational Designs
P.O. Box 12486
Portland, OR 97212
(503)287-8137

Home Accounting, Auto Maintenance Software

Softsync, a company known for its Timex/Sinclair products, has jumped into the Commodore 64 market. Its first two products are *Personal Accountant* and *Computer Mechanic*.

Personal Accountant offers 144 user-defined accounts, including savings, checking, loans, mortgage payments, credit cards, and budgeting. The program also includes functions for detailed forecasting and the preparation of profit/loss statements. It is available for $34.95 on disk, or $29.95 on tape.

Computer Mechanic records service information for more than 20 makes and models of automobiles. The program

COMPUTE!'s First Book Of VIC

Authors: **COMPUTE!** Magazine contributors
Price: $12.95
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Finally, it's VIC's turn!

Users of other popular personal computers have been enjoying their **COMPUTE! Books**: *COMPUTE!'s First Book Of PET/CBM, Programming The PET/CBM*, and others.

Now, there's a book devoted exclusively to the Commodore VIC-20™ Computer: *COMPUTE!'s First Book Of VIC.*

The editors of **COMPUTE!** Magazine – the leading resource for the VIC-20 – gathered together the best VIC-20 articles published since the summer of 1981 and added some new material. The result is more than 200 pages of valuable information – information that goes beyond the instruction manuals. In the **COMPUTE!** tradition, it is carefully edited to be easily understood and useful for beginners and experts alike.

COMPUTE!'s First Book Of VIC is spiral-bound to lie flat, and includes ready-to-type program listings and articles such as "The Joystick Connection: Meteor Maze," "STARFIGHT3," "Train Your PET To Run VIC Programs," "Renumber BASIC Lines The Easy Way," "High Resolution Plotting," "Custom Characters For The VIC," "VIC Memory – The Uncharted Adventure," and "A Simple Monitor For The VIC."

At only $12.95, less than most computer manuals, *COMPUTE!'s First Book Of VIC* is among the best resources a VIC user can own.

v Introduction ..... Robert Lock

Chapter One: Getting Started.

3 The Story Of The VIC ..... Michael S. Tomczyk
11 Computer Genesis: From Sticks And Stones To VIC ..... Dorothy Kunkin Heller / David Thornburg
20 Super Calculator ..... Jim Butterfield
24 Large Alphabet ..... Doug Ferguson
26 Using A Joystick ..... David Malmberg
39 Extended Input Devices: Paddles And The Keyboard ..... Mike Bassman / Salomon Lederman
46 Game Paddles ..... David Malmberg

Chapter Two: Diversions – Recreation And Education.

59 The Joystick Connection: Meteor Maze ..... Paul L. Bupp / Stephen P. Drop
67 ZAP!! ..... Dub Scroggin
72 STARFIGHT3 ..... David R. Mizner
78 Alphabetizer ..... Jim Wilcox
80 Count The Hearts ..... Christopher J. Flynn

Chapter Three: Programming Techniques.

89 PRINTing With Style ..... James P. McCallister
97 Train Your PET To Run VIC Programs ..... Lyle Jordan
99 User Input ..... Wayne Kozun
103 Amortize ..... Amihai Glazer
106 Append ..... Wayne Kozun
109 Printing The Screen ..... C. D. Lane
113 The Confusing Quote ..... Charles Brannon
115 Alternate Screens ..... Jim Butterfield
119 Timekeeping ..... Keith Schleiffer
125 Renumber BASIC Lines The Easy Way ..... Charles H. Gould
127 Automatic Line Numbers ..... Jim Wilcox
129 Putting The Squeeze On Your VIC-20: Getting The Most Out Of 5000 Bytes ..... Stanley M. Berlin
141 An Easy Way To Relocate VIC Programs On Other Commodore Computers ..... Greg and Ross Sherwood

Chapter Four: Color And Graphics.

147 Kaleidoscope And Variations ..... Kenneth Knox
148 High Resolution Plotting ..... Paul F. Schatz
154 VIC Color Tips ..... Charles Brannon
157 The Window ..... Charles Brannon
160 Custom Characters For The VIC ..... David Malmberg

Chapter Five: Maps And Specifications.

173 How To Use The 6560 Video Interface Chip ..... Dale Gilbert
179 Browsing The VIC Chip ..... Jim Butterfield
186 VIC Memory – The Uncharted Adventure ..... David Barron / Michael Kleinert
189 Memory Map Above Page Zero ..... Jim Butterfield

Chapter Six: Machine Language.

195 TINYMON1: A Simple Monitor For The VIC ..... Jim Butterfield
202 Entering TINYMON1 Directly Into Your VIC-20 ..... Russell Kavanagh

211 Index

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VIC-20 is a trademark of Commodore Electronics Limited.

teaches the basics of auto mechanics and allows you to record service information on as many as 100 cars. The program is available for $26.95 on disk, or $21.95 on tape.

Softsync plans to introduce game and utility programs for the 64 in the near future.

Softsync, Inc.
14 East 34 St.
New York, NY 10016
(212)685-2080

Business Utility Package

Superbyte Software has gathered several business applications and utility programs together on disk in a package called the *Business Pack*.

Included in the $100 package are: The Accountant, a general ledger, income statement, and balance sheet; Accounts Receivable/Payable, a journal for current and paid accounts; The Editor, a word processor; Spread Sheet Calc, a spread sheet/calculating program; Business Inventory, an inventory control system; Checkbook Mate, a checkbook maintenance and check-writing program; The Mailman, an address file.

In addition, the package contains the following utilities: a profit margin calculator, a business calendar and data base, and programs for linear regression analysis, depreciation, and amortization.

Business Pack is available for the Commodore 64 and 8K VIC-20.

Superbyte Software
2 Chipley Run
West Berlin, NJ 08091
(609)346-3063

Learn Russian

A beginning Russian course for the unexpanded VIC-20 is available from Russian Software.

The $23.95 program provides the user with a Russian screen typing font and introduces the beginner to the Russian alphabet and basic vocabulary.

Russian Software
Box 36, 1744 W. Devon
Chicago, IL 60660

Business And Pleasure

T & F Software has released a checkbook program for the Commodore 64 and VIC-20, as well as a space action game for the 64 and a series of word search games for the VIC-20 and 64.

CheckEase!, which requires an 8K VIC or 64, can be used with multiple accounts. Checks can be deleted or the amounts can be changed, and the program will update all balance figures. Printouts can be made by check number, category, or by tax deductible items.

CheckEase! is available for $24.95 for the VIC-20 version, $29.95 for the 64 tape version, and $34.95 for the 64 disk version.

Another new T & F program is *Space Sentinel*. In the game, you defend the planet Earth against a group of aliens who hurl heat missiles at our polar ice caps. If you fail, the melting ice caps flood the planet. The game is available on disk for $29.95.

The company's Search Series consists of *Word Search*, *Sport Search*, and *Arcade Search*, all on cassette for $19.95.

Each game puts 374 letters on the screen and gives you ten minutes to find the 20 hidden words. There are three categories for each game.

T & F Software Company
10902 Riverside Drive
North Hollywood, CA 91602
(213) 501-5845

Auxiliary Keyboard

Gosub International has developed a 20-key auxiliary keyboard for the Commodore 64 or expanded VIC-20. The system consists of the keypad and a 330-byte driver program.

The Flexikey System is designed to enhance data entry on Commodore computers. The system allows the user to define key values. Nineteen of the 20 keys can be programmed with up to three values. The 20th key, the PROG key, is used to switch among the three modes.

In the first two modes, each key can be defined as any single key on the Commodore keyboard. In the third mode, the programmed function mode, the definitions may be up to three bytes long. On initialization, mode one is defined to be useful

as a calculator; mode two is set up with definitions useful to machine language programmers.

Keyboard definitions for the Flexikey System, which sells for $69.95, can be saved and reloaded.

Gosub International, Inc.
501 E. Pawnee, #430
Wichita, KS 67211

Expansion For VIC

Century Micro has produced a 64K expansion cartridge for the VIC-20. The cartridge includes 64K of RAM organized as two sets of blocks 1,2,3, and 5. Programs can be stored and accessed in either set, and all eight banks are software selectable.

Century Micro's cartridge is available for $199.95.

Century Micro
1832 Tribute Road
Suite 213
Sacramento, CA 95815
(916) 920-3656

Pair Of Printers

Cardco has developed two new printers for the VIC-20 and Commodore 64.

The Cardprinter/LQ1 is a letter quality daisy-wheel printer. It prints at 14 characters per second in either red or black and includes bold, shadow, and underline printing in normal or proportional modes. The printer is expected to sell for $599.95. Options for a tractor feeder, cut-sheet feeder, or keyboard for direct printing are available.

The Cardprinter/DM1 is a small dot matrix impact printer. It is capable of printing 40 columns of text on 3-inch adding machine paper. Cardprinter/DM1, which will sell for $149.95, has a print speed of 50 characters per second, and can print full

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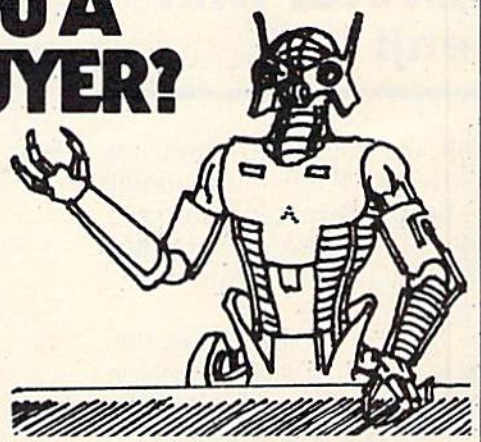

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313 Mathewson Ave.
Wichita, KS 67214
(316)267-6525

VIC Games

Synapse Software, a producer of games for Atari computers, has established the Showcase Software line for the VIC-20.

The initial games produced are *Astro-Patrol*, a shoot-em-up game; *Squeeze*, a humorous game set on a farm; and *Salmon Run*. Each game sells for $19.95.

Synapse Software
5221 Central Avenue, #200
Richmond, CA 94804

Beat The Dealer

M-R Information Systems has produced a blackjack game for the VIC-20. *MicRo Blackjack*, which requires at least 3K expansion, is available on cassette for $14.95.

M-R Information Systems, Inc.
P.O. Box 73
Wayne, NJ 07470
(201)696-3296

Computer Hypnosis

The Hypnotist II for the Commodore 64 has been released by Psycom Software International.

The program contains five major modules: introduction and vital data gathering; relaxation and stress reduction through biofeedback; trance induction; neural reprogramming and suggestion; and return to consciousness.

The Hypnotist II will sell for $59.90 and includes a biofeedback device which can be used with other Psycom products.

Psycom Software International
2118 Forest Lake Drive
Cincinnati, OH 45244

VIC's Voice

Speakeasy is a voice synthesizer designed to allow voice to be added to adventure and cartridge games on the VIC-20. It comes in a cartridge that plugs into the VIC's expansion port.

Discover With Benji

Benji, the dog made famous in children's TV adventure movies, has been incorporated into a series of educational computer games by Human Engineered Software.

In *Benji – Space Rescue*, the dog is sent on a rescue mission in space. Children playing the program will be introduced to the solar system while helping Benji complete his mission.

The game is available for the VIC-20 and Commodore 64 for $44.95. Versions for other computers are planned.

Human Engineered Software
71 Park Lane
Brisbane, CA 94005

Benji, the movie star dog, has become a computer game star.

The synthesizer, produced by Personal Peripheral Products, can be programmed from BASIC or machine language by POKEing to only one address. The package includes an editor that allows the user to append, insert, and delete phonemes in strings to create phrases and sentences.

The 256 phoneme buffer can be stored on tape or disk. The *Speakeasy* cartridge, including the editor tape, sells for $79.

Personal Peripheral Products
P.O. Box 3423 Fox Valley Mall
Aurora, IL 60505

Mapping Memory

The Master Memory Map, a reference guide to computer memory, is available in VIC-20 and Commodore 64 versions from Educational Software.

The book includes sections on PEEKing and POKEing, paddles and joysticks, color locations, single and multiple sound registers, graphics registers, and sprites.

The VIC version is available for $9.95; the 64 version is available for $14.95.

Educational Software, Inc.
4565 Cherryvale Ave.
Soquel, CA 95073
(408)476-4901

Mailing List

Galactic Software has announced a mailing list program that can double as a small data base manager.

'20 Mailing List allows alphabetizing on entry, sorting and searching in all fields, printing labels or complete records. Each entry can contain name, address, and three comment fields.

The program, which is menu driven, requires at least 16K expansion. It is available on tape for $25.95, or disk for $27.95.

Galactic Software
P.O. Box 10516
San Jose, CA 95157
(408)247-4434

Extra VIC Port

MFJ Electro Enterprises has produced an add-on port to allow the VIC-20 to use a second joystick.

The port is available for $21.50 and includes programming instructions and a sample two-player game. The sample game requires 3K or 8K expansion to run.

MFJ Electro Enterprises
P.O. Box 13076
Kanata, Ontario
Canada K2K 1X3

VIC Graphics

Hayden Book Company has published *VIC Graphics*, a detailed explanation of the high-resolution graphics capabilities of the VIC-20.

The book, written by Nick Hampshire, includes 38 BASIC program listings on applications from art and games to education and business. The programs require the use of the VIC Super Expander cartridge.

VIC Graphics, a 192-page book, sells for $12.95.

Hayden Book Company, Inc.
50 Essex St.
Rochelle Park, NJ 07662
(201)843-0550

COMPUTE!'s Gazette *for Commodore welcomes announcements of new products for VIC-20 and Commodore 64 computers, especially products aimed at beginning to intermediate users. Please send press releases and photos well in advance to: Tony Roberts, Assistant Managing Editor,* COMPUTE!'s Gazette, *P.O. Box 5406, Greensboro, NC 27403.*

New product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication.

Writers, programmers...

COMPUTE!'s Gazette
is looking for articles on the VIC and 64.

Bug-Swatter:
Modifications And Corrections

• Several problems with the Commodore 64 version of the "Skydiver" game in our Premier Issue have been brought to our attention by readers. When tracking down the cause of the problems, we discovered that the Commodore 64 listing was not the programmer's final version. Rather than reprint the entire listing, we are printing the lines which need to be changed or added. This way, readers who have already typed in the program don't have to compare their version line by line with the correct version.

To fix Commodore 64 Skydiver, change or add these lines:

```
12 A(1)=1191:A(2)=1200:A(3)=1210
16 PRINT"{HOME}{3 RIGHT}SCORE:{3 SPACES}";
200 B=1144+A:T=INT(RND(TI)*8+1):T=T+1
220 POKEB,CH:POKEB,32:B=B+40
3010 IFP=1THENIFB=1831ORB=1832ORB=1833ORB
     =1834 THENPOKEB,CH:GOTO4000
3020 IFP=2THENIFB=1842ORB=1843ORB= 1844TH
     ENPOKEB,CH:GOTO4050
3030 IFP=3THENIFB=1854ORB=1855ORB=1856ORB
     =1857ORB=1858THENPOKEB,CH:GOTO4100
4000 PRINT"{HOME}{8 DOWN}{10 RIGHT}5 X";B
     O;"=";5*BO
5040 FORI=1944TO2023:POKEI+T7,6:POKEI,160
     :NEXT
5053 IFNJ>=NETHENBO=BO+50:PRINT"{HOME}
     {5 RIGHT}{8 DOWN}{3 RIGHT}BONUS ADVA
     NCE TO{RED}";BO:PRINT"{BLU}"
5056 PRINT"{HOME}{3 DOWN}{8 RIGHT}";"WIND
     :";SD"TO ";D$:GOSUB50000
5057 FORK=1TO1000:NEXT:PRINT"{HOME}
     {3 DOWN}{25 SPACES}"
5060 FORI=1104TO1904STEP40:POKEI,96:POKEI
     +39,96:NEXT
10100 FOR P=1 TO VA/10:SC=SC+10:PRINT"
      {HOME}{BLU}SCORE:{RED}";SC:NEXT
12000 PRINT"{HOME}{8 DOWN}{6 RIGHT}SORRY
      NO BONUS!":BA=BA-1
50010 PRINT"{HOME}{6 RIGHT}{4 DOWN}{RED}
      5X{7 SPACES}10X{7 SPACES}2X{BLU}":P
      =1:Z=P
50025 POKEA(P),PEEK(A(P))+128AND255:PRINT
50028 PRINT"{HOME}{5 DOWN}{9 RIGHT}";
50029 PRINT"{7 RIGHT}{DOWN}{2 SPACES}";TA
      B(10);"{2 SPACES}{3 LEFT}";TM:IFTM=
      0THENP=INT(RND(TI)*3+1):GOTO50100
50035 IFFR= 0THEN50100
50120 PRINT"{HOME}{7 RIGHT}{13 DOWN} YOU
      MUST LAND ON ";A$
60000 PRINT"{HOME}{7 DOWN}{10 RIGHT}GAME
      OVER":IFSC>HITHENHI=SC
60100 POKE53281,1 :POKE53280,6{3 SPACES}:
      PRINT"{CLR}{4 DOWN}{11 SPACES}{BLK}
       SKY DIVER"
```

Remember to consult last month's "Bug-Swatter" about proper spacing in line 100 for both the 64 and VIC versions of Skydiver. Spacing is critical in this and many other game programs; some readers are mistakenly omitting the space immediately before the left-cursor symbol in line 120 of the VIC version. Also, the unexpanded VIC and 64 versions do not have sound effects – only the VIC Super Expander version.

• Speaking of proper spacing, our printer made it appear that quite a few spaces should be typed on line 6000 of the VIC-20 "Snake Escape," July issue. Actually, no spaces should be typed between the SHIFTed V's.

• There are several corrections to the Commodore 64 version of "The Viper," August issue. On lines 570 and 610, [LOWER] should be entered as CHR$(14). This shifts the computer into lowercase mode. On line 690, the number 320 should be substituted for the open parens and CTRL-P. Here is the corrected version:

```
690 FORJ=1TODT:POKESC+80+I*320+MA(J)+C,3:
    POKESC+MA(J)+80+I*320,160:NEXTJ
```

In some August issues, a tiny spec of dust introduced in the production process makes the SYS statement in line 1020 hard to interpret. The correct statement is SYS893. Finally, in line 1420, the printer apparently burped and threw a question mark into the DATA statement. The question mark should be omitted; the correct number is 197.

• In the September issue, there were two typographical errors in formulas in the "VICreations" column. The last whole sentence at the bottom of page 78 should read: "(RND(1)*A)+B is the main body of our random number generator." On page 79, the second random number formula in the first column should read: "X=INT (RND(1)*100)+100." In both cases, an equals sign was incorrectly substituted for the last plus sign in the formulas.

• Reader Kim Pugh suggests a change to improve the Commodore 64 version of "Snake Escape," published in the July issue. To modify the program to work with a joystick plugged into port one instead of the keyboard, Pugh suggests changing these lines:

```
190 K=PEEK(56321)AND15:POKE198,0
200 IF K=11 THEN DR=-1:GOTO 250:REM LEFT
210 IF K=7 THEN DR=1:GOTO 250:REM RIGHT
220 IF K=14 THEN DR=-40:GOTO 250:REM UP
230 IF K=13 THEN DR=40:GOTO 250:REM DOWN
```

Delete line 4030 and change line 4040 to the following:

```
4040 PRINT"{DOWN}{BLK}PUSH THE JOYSTICK
     IN THE DIRECTION YOU WISH TO MOVE."
```

We appreciate receiving both corrections and suggested modifications from readers. Please address them to:

Bug-Swatter
c/o COMPUTE!'s Gazette
P.O. Box 5406
Greensboro, NC 27403

A Beginner's Guide To Typing In Programs

What Is A Program?

A computer cannot perform any task by itself. Like a car without gas, a computer has *potential*, but without a program, it isn't going anywhere. Most of the programs published in *COMPUTE!'s Gazette* for Commodore are written in a computer language called BASIC. BASIC is easy to learn and is built into all VIC-20s and Commodore 64s.

BASIC Programs

Each month, *COMPUTE!'s Gazette* for Commodore publishes programs for both the VIC and 64. To start out, type in only programs written for your machine, e.g., "VIC Version" if you have a VIC-20. Later, when you gain experience with your computer's BASIC, you can try typing in and converting certain programs from another computer to yours.

Computers can be picky. Unlike the English language, which is full of ambiguities, BASIC usually has only one "right way" of stating something. Every letter, character, or number is significant. A common mistake is substituting a letter such as "O" for the numeral "0", a lowercase "l" for the numeral "1", or an uppercase "B" for the numeral "8". Also, you must enter all punctuation such as colons and commas just as they appear in the magazine. Spacing can be important. To be safe, type in the listings *exactly* as they appear.

Brackets And Special Characters

The exception to this typing rule is when you see the curved bracket, such as "{DOWN}". Anything within a set of brackets is a special character or characters that cannot easily be listed on a printer. When you come across such a special statement, refer to "How To Type In *COMPUTE!'s Gazette* Programs."

About DATA Statements

Some programs contain a section or sections of DATA statements. These lines provide information needed by the program. Some DATA statements contain actual programs (called machine language); others contain graphics codes. These lines are especially sensitive to errors.

If a single number in any one DATA statement is mistyped, your machine could "lock up," or "crash." The keyboard and STOP key may seem "dead," and the screen may go blank. Don't panic – no damage is done. To regain control, you have to turn off your computer, then turn it back on. This will erase whatever program was in memory, *so always SAVE a copy of your program before you RUN it*. If your computer crashes, you can LOAD the program and look for your mistake.

Sometimes a mistyped DATA statement will cause an error message when the program is RUN. The error message may refer to the program line that READs the data. *The error is still in the DATA statements, though.*

Get To Know Your Machine

You should familiarize yourself with your computer before attempting to type in a program. Learn the statements you use to store and retrieve programs from tape or disk. You'll want to save a copy of your program, so that you won't have to type it in every time you want to use it. Learn to use your machine's editing functions. How do you change a line if you made a mistake? You can always retype the line, but you at least need to know how to backspace. Do you know how to enter inverse video, lowercase, and control characters? It's all explained in your computer's manuals.

A Quick Review

1) Type in the program a line at a time, in order. Press RETURN at the end of each line. Use backspace or the back arrow to correct mistakes.

2) Check the line you've typed against the line in the magazine. You can check the entire program again if you get an error when you RUN the program.

3) Make sure you've entered statements in brackets as the appropriate control key (see "How To Type *COMPUTE!'s Gazette* Programs" elsewhere in the magazine.)

We regret that we are not able to respond to individual inquiries about programs, products, or services appearing in COMPUTE!'s Gazette *for Commodore due to increasing publication activity. On those infrequent occasions when a published program contains a typo, the correction will appear in the magazine, usually within eight weeks. If you have specific questions about items or programs which you've seen in* COMPUTE!'s Gazette *for Commodore, please send them to Gazette Feedback, P.O. Box 5406, Greensboro, NC 27403.*

How To Type In *COMPUTE!'s Gazette* Programs

Many of the programs which are listed in *COMPUTE!'s Gazette* contain special control characters (cursor control, color keys, inverse video, etc.). To make it easy to know exactly what to type when entering one of these programs into your computer, we have established the following listing conventions.

Generally, any VIC-20 or Commodore 64 program listings will contain bracketed words which spell out any special characters: {DOWN} would mean to press the cursor down key. {5 SPACES} would mean to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing the other key), the key would be underlined in our listings. For example, S would mean to type the S key while holding the shift key. This would appear on your screen as a "heart" symbol. If you find an underlined key enclosed in braces (e.g., {10 N}), you should type the key as many times as indicated (in our example, you would enter ten shifted N's).

If a key is enclosed in special brackets, ⟨k⟩, you should hold down the *Commodore key* while pressing the key inside the special brackets. (The Commodore key is the key in the lower left corner of the keyboard.) Again, if the key is preceded by a number, you should press the key as many times as necessary.

Rarely, you'll see a solitary letter of the alphabet enclosed in braces. These characters can be entered on the Commodore 64 by holding down the CTRL key while typing the letter in the braces. For example, {A} would indicate that you should press CTRL-A. You should never have to enter such a character on the VIC-20, but if you do, you would have to leave the quote mode (press RETURN and cursor back up to the position where the control character should go), press CTRL-9 (RVS ON), the letter in braces, and then CTRL-0 (RVS OFF).

About the *quote mode*: you know that you can move the cursor around the screen with the CRSR keys. Sometimes a programmer will want to move the cursor under program control. That's why you see all the {LEFT}'s, {HOME}'s, and {BLU}'s in our programs. The only way the computer can tell the difference between direct and programmed cursor control is the quote mode.

Once you press the quote (the double quote, SHIFT-2), you are in the quote mode. If you type something and then try to change it by moving the cursor left, you'll only get a bunch of reverse-video lines. These are the symbols for cursor left. The only editing key that isn't programmable is the DEL key; you can still use DEL to back up and edit the line. Once you type another quote, you are out of quote mode.

You also go into quote mode when you INSerT spaces into a line. In any case, the easiest way to get out of quote mode is to just press RETURN. You'll then be out of quote mode and you can cursor up to the mistyped line and fix it.

Use the following table when entering cursor and color control keys:

When You Read:	Press:	See:	When You Read:	Press:	See:	When You Read:	Press:	See:
{CLEAR}	SHIFT CLR/HOME		{CYN}	CTRL 4		⟨7⟩	C= 7	
{HOME}	CLR/HOME		{PUR}	CTRL 5		⟨8⟩	C= 8	
{UP}	SHIFT ↑ CRSR ↓		{GRN}	CTRL 6		{F1}	f1	
{DOWN}	↑ CRSR ↓		{BLU}	CTRL 7		{F2}	f2	
{LEFT}	SHIFT ⇐ CRSR ⇒		{YEL}	CTRL 8		{F3}	f3	
{RIGHT}	⇐ CRSR ⇒		⟨1⟩	C= 1		{F4}	f4	
{RVS}	CTRL 9		⟨2⟩	C= 2		{F5}	f5	
{OFF}	CTRL 0		⟨3⟩	C= 3		{F6}	f6	
{BLK}	CTRL 1		⟨4⟩	C= 4		{F7}	f7	
{WHT}	CTRL 2		⟨5⟩	C= 5		{F8}	f8	
{RED}	CTRL 3		⟨6⟩	C= 6				

The Automatic Proofreader

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs" and "A Beginner's Guide To Typing In Programs" that appear before the Program Listings. Also, see the article "Automatic Proofreader."

Program 1:
The Automatic Proofreader For VIC

```
100 FOR I=828 TO 932:READ A:POKE I,A:NEXT
    :PRINT"{CLR}{RVS}SYS 828{OFF} TO ACTI
    VATE.{2 DOWN}"
110 POKE178,165:PRINT"SYS 828{HOME}":END
120 DATA169,75,141,36,3,169,3,141
130 DATA37,3,169,0,133,255,96,32
140 DATA14,242,133,252,134,253,132,254
150 DATA8,201,13,240,17,201,32,240
160 DATA5,24,101,255,133,255,165,252
170 DATA166,253,164,254,40,96,169,13
180 DATA32,210,255,165,214,141,165,3
190 DATA206,165,3,169,0,133,216,169
200 DATA19,32,210,255,169,18,32,210
210 DATA255,169,58,32,210,255,166,255
220 DATA169,0,32,205,221,169,0,133
230 DATA255,169,32,32,210,255,32,210
240 DATA255,173,165,3,133,214,76,98,3
```

Program 2:
The Automatic Proofreader For The 64

```
100 FOR I=828 TO 932:READ A:POKE I,A:NEXT
    :PRINT"{CLR}{RVS}SYS 828{OFF} TO ACTI
    VATE.{2 DOWN}"
110 POKE178,165:PRINT"SYS 828{HOME}":END
120 DATA169,75,141,36,3,169,3,141
130 DATA37,3,169,0,133,255,96,32
140 DATA87,241,133,252,134,253,132,254
150 DATA8,201,13,240,17,201,32,240
160 DATA5,24,101,255,133,255,165,252
170 DATA166,253,164,254,40,96,169,13
180 DATA32,210,255,165,214,141,165,3
190 DATA206,165,3,169,0,133,216,169
200 DATA19,32,210,255,169,18,32,210
210 DATA255,169,58,32,210,255,166,255
220 DATA169,0,32,205,189,169,0,133
230 DATA255,169,32,32,210,255,32,210
240 DATA255,173,165,3,133,214,76,98,3
```

Oil Tycoon

Program 1: Oil Tycoon For VIC, Part I

```
10 REM OIL TYCOON                       :rem 5
20 PRINT"{CLR}":PRINT"{5 SPACES}INSTRUCTI
   ONS":PRINT:PRINT"{PUR}JOYSTICK{BLU}:":
   PRINT" RT & LT=MOVE RIG"             :rem 138
30 PRINT" DOWN=DRILL":PRINT" UP=RETRACT P
   IPE"                                 :rem 80
40 PRINT:PRINT"{PUR}FIREBUTTON{BLU}: W/ P
   IPE;":PRINT" IN OIL OR SPACE=PUMP"
                                        :rem 244
50 PRINT" IN DIRT=DROP DYNAMITE RETRACTED
   =NEW MAN"                            :rem 110
60 PRINT:PRINT"WATCH OUT FOR {PUR}SHALE,
   {3 SPACES}{RED}GAS {BLU}IN {YEL}EMPTY
   {SPACE}SPACES"," {BLU}AND {RED}DEVILS
   {SPACE}{BLU}IN {BLK}OIL"             :rem 145
70 PRINT:PRINT"{BLU}PLEASE WAIT FOR"," FU
   RTHER INSTRUCTIONS"                  :rem 57
80 POKE52,28:POKE56,28:POKE45,248:POKE46,
   26:CLR                               :rem 28
90 FORA=7168TO7375:READB:POKEA,B:NEXT
                                        :rem 70
100 DATA2,138,164,73,74,52,20,8,64,81,37,
    146,82,44,40,16,24,24,36,60,90,102,23
    1,153                               :rem 25
110 DATA20,42,42,20,62,73,20,20,136,34,13
    6,34,136,34,136,34,148,22,148,34,136,
    34,136,34                           :rem 209
120 DATA148,22,148,22,148,34,136,34,148,2
    2,148,22,148,22,148,22,136,62,188,62,
    188,62,188,22                       :rem 197
130 DATA170,170,170,170,170,170,170,170,1
    50,150,150,170,170,170,170,170,150,15
    0,150,150,150                       :rem 134
140 DATA170,170,170,150,150,150,150,150,1
    50,150,150,150,190,190,190,190,190,19
    0,150                               :rem 7
150 DATA0,0,0,0,0,0,0,0,20,20,20,0,0,0,0,
    0,20,20,20,20,20,0,0,0,20,20,20,20,20
    ,20,20,20                           :rem 36
160 DATA20,60,60,60,60,60,60,20,0,60,60,6
    0,60,60,0,0,0,0,255,255,0,0,0
                                        :rem 233
170 DATA218,118,181,153,110,93,197,65,65,
    82,150,85,121,181,150,173,2,106,129,2
    0,64,162,129                        :rem 137
180 DATA2,169,128,141,19,145,169,0,133,13
    6,34,136,34,136,34,136,34           :rem 229
190 FORA=7424TO7640:POKEA,PEEK(25600+A):N
    EXT                                 :rem 114
200 FORA=7464TO7529:READB:POKEA,B:NEXT
                                        :rem 111
210 DATA169,128,141,19,145,169,0,133,1,13
    3,2,169,127,141,34,145,162,119,236,32
    ,145                                :rem 242
220 DATA208,4,169,1,133,1,169,255,141,34,
    145,162,118,236,17,145,208,4,169,22,1
    33,1                                :rem 238
230 DATA162,110,236,17,145,208,4,169,1,13
    3,2,162,122,236,17,145,208,4,169,22,1
    33,2,96                             :rem 124
240 LOAD                                :rem 182
```

Program 2: Oil Tycoon For VIC, Part II

```
1 REM PROG 2                            :rem 127
2 PRINT:PRINT" PRESS STOP ON TAPE"
                                        :rem 100
3 IFPEEK(37137)<100THEN3                :rem 108
4 POKE36879,30:POKE36878,47:DIMA%(21):W=7
  768                                   :rem 235
5 IFZ>B%(T)THENB%(T)=Z                  :rem 58
6 POKE36869,240:PRINT"{CLR}{RED}
  {3 SPACES}"T,"$"Z*100"{BLU}"          :rem 81
7 PRINT:PRINT" LEVEL","HIGH SCORE":rem 83
8 FORA=1TO8:PRINT:PRINT"{3 SPACES}"A,"$"B
  %(A)*100:NEXT:PRINT:PRINT" DIFF.LEVEL?
  {SPACE}12345678{GRN}":T=1             :rem 11
9 SYS7464:POKE38852+T,6:T=T+PEEK(1)-PEEK(
  2):IFT<1ORT>8THENT=1                  :rem 13
```

```
10 POKE38852+T,7:L=3:IFT/2=INT(T/2)THENL=
   2                                  :rem 8
11 S=20:IFT=3ORT=4ORT>6THENS=30       :rem 210
12 N=24:IFT>4THENN=25:L=L+1           :rem 111
13 IFPEEK(37137)>100THEN9             :rem 165
14 POKE36869,255                      :rem 108
23 PRINT"{CLR}":M=5:Z=0:K=0:GOSUB87
                                      :rem 222
24 POKEW+X,14:X=10:M=M-1:P=20:Y=L:GOSUB82
   :IFM<0THEN5                        :rem 238
25 GOSUB61:GOTO34                     :rem 40
26 A=((R*22)+W+X):C=PEEK(A):P=P-1:GOSUB67
                                      :rem 122
27 IFC=NORC=3ORA>8185THENFORA=1TO3:GOSUB9
   9:NEXT:GOTO30                      :rem 38
28 IFRND(1)<.06ANDC=14THEN78          :rem 133
29 FORB=1TO3:POKEA,C+B:GOSUB99:NEXT:R=R+1
                                      :rem 122
30 SYS7464:IFPEEK(1)=22ANDP>0THEN26
                                      :rem 112
31 IFPEEK(2)=22THEN40                 :rem 207
32 IFPEEK(37137)<100THEN46            :rem 213
33 GOTO30                              :rem 2
34 SYS7464:A=PEEK(1):B=PEEK(2):IFA=22THEN
   R=1:GOTO26                         :rem 112
35 IFB=22THEN34                       :rem 112
36 IFPEEK(37137)<100THEN24            :rem 213
37 IFA>0ORB>0THENPOKEW+X,14:X=X+A-B:IFX>2
   1THENX=21                          :rem 173
38 IFX<0THENX=0                       :rem 178
39 POKEW+X,2:GOTO34                   :rem 173
40 IFR=1THEN34                         :rem 73
41 R=R-1:B=(R*22)+W+X:C=PEEK(B):FORA=1TO3
   :POKEB,C-A:GOSUB99:NEXT            :rem 216
42 P=P+1:GOSUB67:IFR=1THEN44          :rem 230
43 GOTO30                              :rem 3
44 FORA=W+44TO8185:IFPEEK(A)=9THEN34
                                      :rem 188
45 NEXT:M=M+1:FORC=1TO3:GOSUB82:NEXT:GOSU
   B87:GOSUB61:GOTO34                 :rem 126
46 J=Z:Q=R-1:FORA=0TO21:A%(A)=0:NEXT:B=(Q
   *22)+W+X:A=PEEK(B):IFA=7THEN69     :rem 42
47 A%(X)=1:POKE36877,252:POKE36878,36:V=W
   +X-22:IFA=12THENPOKEB,17:Z=Z+Q:POKEV,0
                                      :rem 11
48 E=0:F=20:D=1:G=1:I=1:GOSUB52:POKEV,1:E
   =21:F=1:D=-1:G=D:I=D:GOSUB52       :rem 147
49 E=0:F=21:D=1:G=-22:I=0:GOSUB52:POKEV,0
   :IFC=6THEN85                       :rem 193
50 IFH=0THENPOKEV,14:POKE36877,0:POKE3687
   8,47:GOSUB82:GOSUB61:GOTO30        :rem 237
51 Q=Q-1:GOTO48                       :rem 130
52 IFC=6THENRETURN                    :rem 187
53 H=0:FORA=ETOFSTEPD:IFA%(A)=0THEN60
                                      :rem 45
54 B=(Q*22)+W+A+G:C=PEEK(B)           :rem 234
55 IFC=9ORC=12THENPOKEB,C+5:H=1:Z=Z+(Q+(A
   BS(I)-1)):A%(A+I)=1:GOTO59         :rem 204
56 IFC=14ORC=17THENA%(A+I)=1:H=1:GOTO60
                                      :rem 58
57 IFC=3THENC=6:RETURN                :rem 173
58 A%(A+I)=0:GOTO60                    :rem 31
59 IFRND(1)<.02ANDC<>12THENC=6:RETURN
                                      :rem 33
60 NEXT:RETURN                        :rem 191
61 PRINT"{HOME}"SPC(13)"$"Z*100       :rem 99
62 A=INT(Z/1000):IFA=K+1THENK=K+1:GOSUB82
   :GOSUB82:M=M+1                     :rem 109
63 IFM<1THENPOKE7680,14:GOTO65        :rem 84
64 FORA=7680TO7679+M:POKEA,2:NEXT:POKEA,1
   4                                  :rem 88
65 IFY=0THENPOKE7687,14:GOTO67        :rem 107
66 FORA=7687TO7686+Y:POKEA,19:NEXT:POKEA,
   14                                 :rem 163
67 IFP<1THENPOKE7702,14:RETURN        :rem 146
68 FORB=7702TO7701+P:POKEB,17:NEXT:POKEB,
   14:RETURN                          :rem 159
69 A=W+X:B=240:IFY<1THEN30            :rem 55
72 A=A+22:C=PEEK(A):POKEA,C+1:IFC=14ORC=9
   THENPOKEA,C+4                      :rem 18
73 POKE36875,B:FORD=0TO200:NEXT:D=PEEK(A+
   22)                                :rem 149
74 IFD<>4ANDD<>NANDD<>3ANDA<8164THENB=B-5
   :POKEA,C:GOTO72                    :rem 249
75 POKE36875,0:GOSUB93:POKEA+30742,15
                                      :rem 145
76 IFC<>14ANDC<>9THENR=R-1             :rem 85
77 Y=Y-1:GOSUB65:GOTO30               :rem 182
78 FORB=1TO2:POKEA,C+B:GOSUB99:NEXT:GOSUB
   93:B=150                           :rem 123
79 R=R-1:POKE36878,36:IFR<1THENPOKE36878,
   47:GOTO81                          :rem 38
80 POKE36877,B:A=(R*22)+W+X:C=PEEK(A):POK
   EA,C+1:FORD=0TO200:NEXT:POKEA,C-3:B=B+
   5:GOTO79                           :rem 31
81 POKEW+X,23:GOSUB83:GOTO24           :rem 1
82 FORA=47TO32STEP-1:POKE36878,A:POKE3687
   6,237:FORB=1TO25:NEXTB,A:POKE36876,0:P
   OKE36878,47:RETURN                  :rem 1
83 POKE36877,220:FORD=47TO32STEP-1:POKE36
   878,D:POKE36879,26:FORE=1TO70:NEXT:POK
   E36879,31                          :rem 112
84 NEXT:POKE36877,0:POKE36878,47:POKE3687
   9,30:RETURN                        :rem 178
85 Z=J:POKEB,3:POKEB+30720,2:POKEV,14:FOR
   A=0TO40:POKE36876,240:POKE36878,230:FO
   RB=1TO5:NEXT                       :rem 67
86 POKE36878,0:FORB=1TO5:NEXTB,A:POKE3687
   6,0:B=150:GOTO79                   :rem 223
87 FORA=7790TO8185:POKEA,4:POKEA+30720,15
   :NEXT:B=220:C=7812:FORA=1TO2:FORD=1TO8
   0                                  :rem 102
88 E=(RND(0)*B)+C:IFPEEK(E)=9THEN88
                                      :rem 27
89 POKEE,9:POKEE+30720,8:NEXT:B=154:C=803
   2:NEXT:FORA=1TOS                   :rem 21
90 B=(RND(1)*374)+7812:C=PEEK(B):IFC=9ORC
   =NTHEN90                           :rem 95
91 POKEB,N:NEXT:FORA=0TO109:POKE38400+A,0
   :NEXT:FORA=0TO21:POKE38444+A,3:POKE772
   4+A,20:NEXT                        :rem 67
92 FORA=0TO3:POKE38407+A,2:NEXT:RETURN
                                      :rem 162
93 POKEA,21:POKEA+22,22:GOSUB83:POKEA,14:
   POKEA+22,14:RETURN                 :rem 120
99 POKE36874,200:FORE=1TO10:NEXT:POKE3687
   4,0:RETURN                         :rem 167
```

Program 3: Oil Tycoon For 64

```
100 PRINT"{CLR}{7}":IFPEEK(14336)=2ANDP
    EEK(14805)=24THEN195              :rem 250
105 POKE53280,6:POKE53281,6:POKE53270,8
                                      :rem 197
110 PRINTTAB(14)"INSTRUCTIONS"SPC(28)"
    {12 T}":PRINT"{DOWN}JOYSTICK:"
                                      :rem 244
115 PRINT"{DOWN} RIGHT AND LEFT = MOVE RI
    G"                                :rem 75
120 PRINT" DOWN = DRILL":PRINT" UP = RETR
    ACT PIPE"                         :rem 128
125 PRINT"{2 DOWN}{2 SPACES}WHEN YOU PUSH
     THE FIRE BUTTON AND THE          :rem 111
```

```
130 PRINT"PIPE IS DOWN IN OIL OR IN SPACE
    THE"                              :rem 147
135 PRINT"PUMP IS TRIGGERED.{2 SPACES}IF
    {SPACE}THE PIPE IS DOWN"          :rem 133
140 PRINT"IN DIRT, DYNAMITE IS DROPPED.
                                      :rem 109
145 PRINT"{2 DOWN}WATCH OUT FOR SHALE AND
     GAS IN EMPTY","SPACES AND DEVILS IN
    {SPACE}OIL.                       :rem 116
150 PRINT"{2 DOWN}PLEASE {CYN}WAIT{7} F
    OR FURTHER INSTRUCTIONS."         :rem 155
155 POKE52,56:POKE56,56:CLR:AD=14336
                                      :rem 75
160 FORA=ADTOAD+207:READB:POKEA,B:NEXT:PO
    KE56334,PEEK(56334)AND254:POKE1,51
                                      :rem 69
165 FORA=AD+256TOAD+471:POKEA,PEEK(38912+
    A):NEXT:POKE1,55                  :rem 165
170 POKE56334,PEEK(56334)OR1          :rem 69
175 PRINT"{UP}{2 SPACES}PRESS ANY KEY WHE
    N READY TO BEGIN. "               :rem 58
180 IFPEEK(197)=64ANDPEEK(653)=0ANDPEEK(5
    6320)=127THEN180                  :rem 34
185 :                                 :rem 216
190 :                                 :rem 212
195 PRINT"{CLR}":POKE53280,6:POKE54296,15
    :DIMA%(40):W=1184:JS=56320        :rem 180
200 POKE53282,6:POKE53283,0:POKE53270,24:
    POKE54291,0:POKE54292,240         :rem 232
205 FORI=0TO2:POKE54276+I*7,8:NEXT:POKE53
    281,3                             :rem 247
210 POKE54284,0:POKE54285,240:POKE54277,0
    :POKE54278,240:IFZ>B%(T)THENB%(T)=Z
                                      :rem 154
215 POKE53272,21:PRINT"{CLR}{DOWN}{RED}",
    T,"{2 SPACES}$"MID$(STR$(Z*100),2)".0
    0{BLU}"                           :rem 89
220 PRINTTAB(8)"{DOWN} LEVEL{6 SPACES}HIG
    H SCORE{DOWN}"                    :rem 251
225 FORA=1TO8:PRINT,A,"{2 SPACES}$"MID$(S
    TR$(B%(A)*100),2)".00":PRINT:NEXT
                                      :rem 179
230 PRINT"{DOWN} DIFFICULTY LEVEL? 123456
    78{GRN}":T=1                      :rem 223
235 POKE56194+T,0:T1=T:T=T+(PEEK(JS)AND4)
    /4-(PEEK(JS)AND8)/8:T=(7ANDT-1)+1
                                      :rem 76
240 IFT<>T1THENPOKE56194+T1,6         :rem 241
245 POKE56194+T,1:L=3:IFT/2=INT(T/2)THENL
    =2                                :rem 59
250 S=20:IFT=3ORT=4ORT>6THENS=30       :rem 7
255 N=24:IFT>4THENN=25:L=L+1          :rem 168
260 GETA$:IF(PEEK(56320)AND16)=16ANDA$<>C
    HR$(13)THEN235                    :rem 124
265 POKE53272,31:PRINT"{CLR}":POKE53280,9
    :POKE53281,1:M=4:Z=0:K=0:GOSUB590
                                      :rem 217
270 POKEW+X,14:X=20:P=20:Y=L:R=1:GOSUB705
    :GOSUB645:POKE198,0               :rem 185
275 :                                 :rem 216
280 :                                 :rem 212
285 REM MAIN LOOP OF PROGRAM          :rem 143
290 A=PEEK(JS):IF(AAND4)=0ANDR=1THENPOKEW
    +X,14:X=X+(X>0)                   :rem 192
295 IF(AAND8)=0ANDR=1THENPOKEW+X,14:X=X-(
    X<39)                             :rem 58
300 POKEW+X,2:IF(AAND2)=0ANDP>0THEN340
                                      :rem 30
305 IF(AAND1)=0ANDR>1THEN400          :rem 129
310 IF(AAND16)=0THEN435               :rem 39
315 GETA$:IFR=1ANDA$=" "THEN375       :rem 238
320 GOTO290                           :rem 105
325 :                                 :rem 212
330 :                                 :rem 208
335 REM DRILLING AND GAS EXPLOSIONS
                                      :rem 150
340 A=R*40+W+X:C=PEEK(A):P=P-1:GOSUB675
                                      :rem 60
345 IFC=NORC=3ORA>2023THENFORA=1TO3:GOSUB
    730:NEXT:GOTO290                  :rem 170
350 IFRND(1)>.06ORC<>14THENFORB=1TO3:POKE
    A,C+B:GOSUB730:NEXT:R=R+1:GOTO290
                                      :rem 150
355 FORB=1TO2:POKEA,C+B:GOSUB730:NEXT:GOS
    UB735:B=0                         :rem 158
360 R=R-1:POKE54296,4:IFR<1THENPOKE54296,
    15:POKEW+X,23:GOSUB715:GOTO375
                                      :rem 106
365 POKE54273,B:POKE54276,129:A=R*40+W+X:
    C=PEEK(A):PK=PEEK(A+54272):POKEA,C+1
                                      :rem 244
370 POKEA+54272,15:FORD=0TO200:NEXT:POKEA
    ,C-3:POKEA+54272,PK:B=B+10:GOTO360
                                      :rem 247
375 POKEW+X,14:X=20:M=M-1:P=20:Y=L:R=1:GO
    SUB705:IFM<0THEN205               :rem 182
380 GOSUB645:GOTO290                  :rem 200
385 :                                 :rem 218
390 :                                 :rem 214
395 REM DRILLING UP                   :rem 127
400 R=R-1:B=R*40+W+X:C=PEEK(B):FORA=1TO3:
    POKEB,C-A:GOSUB730:NEXT           :rem 222
405 P=P+1:GOSUB675:IFR<>1THEN290      :rem 190
410 FORA=W+80TO2023:IFPEEK(A)=9THEN290
                                      :rem 14
415 NEXT:M=M+1:FORC=1TO3:GOSUB705:NEXT:GO
    SUB590:GOSUB645:GOTO290           :rem 124
420 :                                 :rem 208
425 :                                 :rem 213
430 REM DYNAMITE, GUSHERS, DEVILS     :rem 22
435 J=Z:Q=R-1:FORA=0TO21:A%(A)=0:NEXT:B=Q
    *40+W+X:A=PEEK(B):IFA<>7THEN480
                                      :rem 117
440 A=W+X:B=40:IFY<1THEN290           :rem 102
445 A=A+40:C=PEEK(A):POKEA,C+1:IFC=14ORC=
    9THENPOKEA,C+4                    :rem 70
450 POKE54273,B:POKE54276,33:FORD=0TO200:
    NEXT:D=PEEK(A+40)                 :rem 191
455 IFD<>4ANDD<>NANDD<>3ANDA<1984THENB=B-
    2:POKEA,C:GOTO445                 :rem 96
460 POKE54276,8:GOSUB735:POKEA+54312,15
                                      :rem 244
465 IFC<>14ANDC<>9THENR=R-1           :rem 135
470 Y=Y-1:GOSUB665:GOTO290             :rem 81
475 :                                 :rem 218
480 A%(X)=1:POKE54273,40:POKE54276,129:PO
    KE54296,4:V=W+X-40                :rem 91
485 IFA=12THENPOKEB,17:Z=Z+Q:POKEV,0
                                       :rem 7
490 E=0:F=38:D=1:G=1:I=1:GOSUB530:POKEV,1
    :E=39:F=1:D=-1:G=D:I=D:GOSUB530
                                      :rem 56
495 E=0:F=39:D=1:G=-40:I=0:GOSUB530:POKEV
    ,0:IFC<>6THEN515                  :rem 155
500 Z=J:POKEB,3:POKEB+54272,2:POKEV,14:FO
    RA=0TO40:POKE54280,88:POKE54283,17
                                      :rem 233
505 POKE53283,14:POKE54296,6:FORB=1TO5:NE
    XT                                :rem 86
510 POKE54296,0:POKE53283,0:FORB=1TO5:NEX
```

```
    TB,A:POKE54283,0:B=0:GOTO360 :rem 134
515 IFHTHENQ=Q-1:GOTO490         :rem 238
520 POKEV,14:POKE54276,8:POKE54296,15:POK
    E54283,2:GOSUB705:GOSUB645:GOTO290
                                 :rem 17
525 :                            :rem 214
530 IFC=6THENRETURN              :rem 236
535 H=0:FORA=ETOFSTEPD:IFA%(A)=0THEN570
                                 :rem 152
540 B=Q*40+W+A+G:C=PEEK(B)       :rem 201
545 IFC=9ORC=12THENPOKEB,C+5:H=1:Z=Z+Q+AB
    S(I)-1:A%(A+I)=1:GOTO565     :rem 144
550 IFC=14ORC=17THENA%(A+I)=1:H=1:GOTO570
                                 :rem 159
555 IFC=3THENC=6:RETURN          :rem 224
560 A%(A+I)=0:GOTO570            :rem 131
565 IFRND(1)<.02ANDC<>12THENC=6:RETURN
                                 :rem 83
570 NEXT:RETURN                  :rem 245
575 :                            :rem 219
580 :                            :rem 215
585 REM INITIALIZE THE DISPLAY   :rem 111
590 PRINT"{HOME}{5 DOWN}{8}";:FORA=1TO9
    9:PRINT"DDDDDDDD";:NEXT:PRINT"DDDDDDD
    ";                           :rem 147
595 POKE2023,4:POKE56295,15:B=400:C=1264:
    FORA=1TO2:FORD=1TO40         :rem 82
600 E=INT(RND(0)*B/2)*2+C:IFPEEK(E)=9ORPE
    EK(E+1)=9THEN600             :rem 61
605 POKEE,9:POKEE+1,9:NEXT:B=360:C=1665:N
    EXT:FORA=1TO5                :rem 121
610 B=INT(RND(1)*340)*2+1264:C=PEEK(B):IF
    C=9ORC=NTHEN610              :rem 246
615 POKEB,N:POKEB+54272,10:NEXT:FORA=0TO1
    99:POKE55296+A,0:NEXT:FORA=0TO39
                                 :rem 15
620 POKE55376+A,3:POKE1104+A,20:NEXT
                                 :rem 62
625 FORA=0TO3:POKE55337+A,2:NEXT:RETURN
                                 :rem 213
630 :                            :rem 211
635 :                            :rem 216
640 REM UPDATE SCREEN INFORMATION :rem 71
645 PRINT"{HOME}{GRN}"SPC(23)"$"MID$(STR$
    (Z*100),2)".00"              :rem 167
650 A=INT(Z/1000):IFA=K+1THENK=K+1:GOSUB7
    05:GOSUB705:M=M+1             :rem 4
655 IFM<1THENPOKE1024,14:POKE55296,14:GOT
    O665                         :rem 184
660 FORA=1024TO1023+M:POKEA,2:POKEA+54272
    ,0:NEXT:POKEA,14:POKEA+54272,0
                                 :rem 207
665 IFY=0THENPOKE1031,14:POKE55303,0:GOTO
    675                          :rem 132
670 FORA=1031TO1030+Y:POKEA,19:POKEA+5427
    2,0:NEXT:POKEA,14:POKEA+54272,0
                                 :rem 16
675 IFP<1THENPOKE1064,14:POKE55336,0:RETU
    RN                           :rem 141
680 FORB=1064TO1063+P:POKEB,17:POKEB+5427
    2,0:NEXT:POKEB,14:POKEB+54272,0
                                 :rem 23
685 RETURN                       :rem 131
690 :                            :rem 217
695 :                            :rem 222
700 REM MUSIC AND OTHER SUBROUTINES
                                 :rem 180
705 POKE54276,17:FORA=15TO0STEP-1:POKE542
    96,A:POKE54273,86:FORB=1TO25:NEXTB,A
                                 :rem 196
710 POKE54276,8:POKE54296,15:RETURN
                                 :rem 82
715 POKE54276,8:POKE54276,129:POKE54273,9
    1:FORD=15TO0STEP-1:POKE54296,D
                                 :rem 205
720 POKE53281,1:POKE53280,2:FORE=1TO70:NE
    XT:POKE53280,6:NEXT          :rem 142
725 POKE54276,8:POKE54296,15:POKE53280,9:
    RETURN                       :rem 40
730 POKE54287,20:POKE54290,8:POKE54290,12
    9:POKE54290,128:RETURN       :rem 181
735 POKEA,21:POKEA+40,22:GOSUB715:POKEA,1
    4:POKEA+40,14:RETURN         :rem 221
740 :                            :rem 213
745 :                            :rem 218
750 REM CHARACTER DATA           :rem 39
755 DATA2,138,164,73,74,52,20,8,64,81,37,
    146,82,44,40,16,24,24,36     :rem 188
760 DATA60,90,102,231,153,20,42,42,20,62,
    73,20,20,136,34,136,34,136,34,136,34
                                 :rem 226
765 DATA148,22,148,34,136,34,136,34,148,2
    2,148,22,148,34,136,34,148,22,148
                                 :rem 128
770 DATA22,148,22,148,22,136,62,188,62,18
    8,62,188,22,170,170,170,170,170
                                 :rem 27
775 DATA170,170,170,150,150,150,170,170,1
    70,170,170,150,150,150,150,150,170,17
    0                            :rem 73
780 DATA170,150,150,150,150,150,150,150,1
    50,150,190,190,190,190,190,190,150,0,
    0                            :rem 65
785 DATA0,0,0,0,0,0,20,20,20,0,0,0,0,0,20
    ,20,20,20,20,0,0,0,20,20,20,20,20,20
                                 :rem 94
790 DATA20,20,20,60,60,60,60,60,60,20,0,6
    0,60,60,60,60,60,0,0,0,0,255,255,0,0,
    0                            :rem 14
795 DATA218,118,181,153,110,93,197,65,65,
    82,150,85,121,181,150,173,2,106,129,2
    0                            :rem 115
800 DATA64,162,129,2,169,128,141,19,145,1
    69,0,133,136,34,136,34,136,34,136,34
                                 :rem 7
```

Re-Beep

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs" and "A Beginner's Guide To Typing In Programs" that appear before the Program Listings. Also, see the article "Automatic Proofreader."

Program 1: Re-Beep For VIC

```
20 A=240:B=225:C=195:D=135:S=36875:R=RND(
   -TI):POKE36878,9:POKE36879,10:W=1
                                 :rem 248
30 PRINT"{CLR}"                  :rem 199
40 FORL=3TO7STEP2:POKE646,L:PRINTSPC(L+1)
   "{4 DOWN}{RVS}RE-BEEP":NEXT:FORM=1TO30
   00:NEXT                       :rem 36
50 INPUT"{CLR}{WHT}{3 DOWN} PLAY LEVEL (1
   -3)";LV:IFLV<1ORLV>3THEN50    :rem 145
60 INPUT"{CLR}{3 DOWN} 1 OR 2 PLAYERS";P
                                 :rem 175
```

```
70 IFP<>1ANDP<>2THEN60                    :rem 85
80 IFP=2THENINPUT"{DOWN}NAME 1";N1$:INPUT
   "{DOWN}NAME 2";N2$                     :rem 75
89 REM CUT EXCESS NAME LENGTH             :rem 239
90 IFLEN(N1$)>12THENN1$=LEFT$(N1$,12)
                                          :rem 77
100 IFLEN(N2$)>12THENN2$=LEFT$(N2$,12)
                                          :rem 120
110 PRINT"{CLR}{CYN}{RIGHT}{RVS}***R E -
    {SPACE}B E E P***{2 DOWN}             :rem 160
120 PRINT"{RVS}{GRN}HIT SPACE BAR TO BEGI
    N                                     :rem 160
130 WAIT197,32                            :rem 251
140 PRINT"{2 UP}{22 SPACES}";:POKE36879,1
    07                                    :rem 1
149 REM SET UP PLAY FIELD                 :rem 173
150 PRINT"{BLK}":FORL=1TO7STEP2:PRINT"F"L
    "{3 DOWN}":NEXT                       :rem 167
160 PRINT"{HOME}{4 DOWN}{GRN}":FORL=1TO4:
    PRINT"{4 RIGHT}{RVS}{2 SPACES}
    {3 DOWN}":NEXT                        :rem 204
170 PRINT"{2 UP}{9 RIGHT}{BLK}TO RESTART
                                          :rem 198
180 PRINT"{DOWN}{9 RIGHT}PRESS '*':rem 99
189 REM PRINT NAMES AND POKE PLAYER NUMBE
    R IF TWO PLAYERS                      :rem 200
190 IFP=2THENPRINT"{HOME}{2 DOWN}
    {9 RIGHT}{RVS}{CYN}"N1$:PRINT"
    {9 DOWN}{9 RIGHT}{RVS}"N2$            :rem 213
200 IFP=2THENPOKE7788,177:POKE8008,178
                                          :rem 236
209 REM LIGHT APPROPRIATE PLAYER NUMBER
                                          :rem 212
210 IFW=1THENPOKE38728,6:POKE38508,1
                                          :rem 129
220 IFW=-1THENPOKE38728,1:POKE38508,6
                                          :rem 175
229 REM RANDOM TONE STRING FORMATION
                                          :rem 254
230 R=INT(RND(1)*4)+1                     :rem 128
240 S$=S$+STR$(R)                         :rem 172
250 FORM=1TO750/LV↑2:NEXT                 :rem 82
259 REM VIC PLAYS IT'S STRING             :rem 221
260 FORL=2TOLEN(S$)STEP2                  :rem 242
270 Q=VAL(MID$(S$,L,1))                   :rem 246
280 GETZ$:REM CLEARS EXTRANEOUS CHARACTER
    S                                     :rem 190
290 ONQGOSUB480,540,600,660:FORM=1TO75/LV
    ↑2:NEXT                               :rem 185
300 NEXT                                  :rem 210
309 REM PLAYER ATTEMPTS A MATCH           :rem 109
310 GETZ$:IFZ$=""THEN310                  :rem 125
320 IFZ$="{F1}"THENGOSUB480:F$=F$+STR$(1)
                                          :rem 8
330 IFZ$="{F3}"THENGOSUB540:F$=F$+STR$(2)
                                          :rem 8
340 IFZ$="{F5}"THENGOSUB600:F$=F$+STR$(3)
                                          :rem 8
350 IFZ$="{F7}"THENGOSUB660:F$=F$+STR$(4)
                                          :rem 17
360 IFZ$="*"THENRUN                       :rem 117
369 REM PLAYER TONE STRING/VIC TONE STRIN
    G COMPARISON                          :rem 121
370 IFLEN(F$)<>LEN(S$)THEN310             :rem 167
380 IFF$<>S$ANDE=0THENF$="":E=1:PRINT"
    {HOME}{9 DOWN}{9 RIGHT}{YEL}{RVS}TRY
    {SPACE}AGAIN":GOSUB770:GOTO250:rem 62
390 PRINT"{HOME}{9 DOWN}{9 RIGHT}
    {9 SPACES}"                           :rem 30
399 REM FAILS SECOND TRY                  :rem 179
400 IFF$<>S$ANDE=1THEN720                 :rem 204
409 REM SCORING (W=-1 INDICATES PLAYER TW
    O)                                    :rem 52
410 E=0:F$="":IFW=1THENS1=S1+1:IFH1<S1THE
    NH1=S1                                :rem 53
420 IFW=-1THENS2=S2+1:IFH2<S2THENH2=S2
                                          :rem 88
430 PRINT"{HOME}";:IFW=-1THENPRINT"
    {10 DOWN}";                           :rem 86
440 IFW=1THENPRINT"{4 DOWN}{9 RIGHT}{PUR}
    {RVS}HIGH ="H1:PRINT"{DOWN}{9 RIGHT}
    {GRN}SCORE="S1                        :rem 53
450 IFW=-1THENPRINT"{4 DOWN}{9 RIGHT}
    {PUR}{RVS}HIGH ="H2:PRINT"{DOWN}
    {9 RIGHT}{GRN}SCORE="S2               :rem 101
460 FORM=1TO750/LV↑2:NEXT                 :rem 85
470 GOTO210                               :rem 103
479 REM NOTE PLAYING SUBROUTINES          :rem 53
480 POKE38514,1:POKE38515,1               :rem 249
490 POKES,A                               :rem 140
500 GOSUB780                              :rem 180
510 POKES,0                               :rem 116
520 POKE38514,5:POKE38515,5               :rem 252
530 RETURN                                :rem 120
540 POKE38602,1:POKE38603,1               :rem 242
550 POKES,B                               :rem 138
560 GOSUB780                              :rem 186
570 POKES,0                               :rem 122
580 POKE38602,5:POKE38603,5               :rem 254
590 RETURN                                :rem 126
600 POKE38690,1:POKE38691,1               :rem 253
610 POKES,C                               :rem 136
620 GOSUB780                              :rem 183
630 POKES,0                               :rem 119
640 POKE38690,5:POKE38691,5                :rem 9
650 RETURN                                :rem 123
660 POKE38778,1:POKE38779,1                :rem 17
670 POKES,D                               :rem 143
680 GOSUB780                              :rem 189
690 POKES,0                               :rem 125
700 POKE38778,5:POKE38779,5                :rem 20
710 RETURN                                :rem 120
720 POKE36874,159:FORM=1TO999:NEXT:POKE36
    874,135:FORM=1TO1500:NEXT:POKE36874,0
                                          :rem 11
730 S1=0:S2=0:S$="":F$="":E=0:REM RESET
                                          :rem 155
740 PRINT"{HOME}";:IFW=-1THENPRINT"
    {10 DOWN}";                           :rem 90
750 PRINT"{6 DOWN}{9 RIGHT}{10 SPACES}":I
    FP=2THENW=-W:REM SWITCH PLAYERS
                                          :rem 183
760 GOTO210                               :rem 105
769 BUZZER/TIMING SUBROUTINES             :rem 226
770 POKE36874,135:FORM=1TO250:NEXT:POKE36
    874,0:RETURN                          :rem 24
780 FORM=1TO600/LV↑2:NEXT:RETURN          :rem 110
```

Program 2: Re-Beep For 64

```
100 REM RE-BEEP{2 SPACES}64               :rem 191
110 S=54272:R=RND(-RND(0)):FORI=0TO4:READ
    H(I),L(I):NEXT:S$=""                  :rem 89
120 FORI=0TO21:POKES+I,0:NEXT             :rem 59
130 POKES+24,15:POKE53280,2:POKE53281,0:W
    =1:D$="{HOME}{25 DOWN}"               :rem 168
140 PRINT"{CLR}"                          :rem 249
150 FORL=3TO7STEP2:POKE646,L:PRINTSPC(L*2
    +5)"{4 DOWN}{RVS}{2 SPACES}RE-BEEP ":
    NEXT                                  :rem 251
```

```
160 FORM=1TO1500:GETA$:IFA$=""THENNEXT
                                    :rem 62
170 INPUT"{CLR}{WHT}{3 DOWN} PLAY LEVEL (
    1-3)";LV:IFLV<1ORLV>3THEN170 :rem 247
180 INPUT"{CLR}{3 DOWN} 1 OR 2 PLAYERS";P
    :IFP<>1ANDP<>2THEN180          :rem 61
190 IFP=2THENINPUT"{DOWN} NAME 1";N1$:INP
    UT"{DOWN} NAME 2";N2$          :rem 125
200 N1$=LEFT$(N1$,12):N2$=LEFT$(N2$,12)
                                    :rem 50
210 PRINT"{CLR}"SPC(10)"{CYN}{RVS}
    {4 SPACES}R E ** B E E P{2 SPACES}
    {2 DOWN}                       :rem 139
220 PRINTSPC(9)"{RVS}{GRN}HIT SPACE BAR T
    O BEGIN"                       :rem 51
230 WAIT197,32:POKE198,0           :rem 99
240 PRINTSPC(9)"{UP}{22 SPACES}";:POKE532
    80,3:POKE53281,6               :rem 59
250 REM SET UP SCREEN             :rem 204
260 PRINT"{BLK}":FORL=1TO7STEP2:PRINTSPC(
    15)"F"L"{2 DOWN}":NEXT         :rem 53
270 PRINT"{HOME}{3 DOWN}{GRN}":FORL=1TO4:
    PRINTSPC(20)"{RVS}{3 SPACES}{2 DOWN}"
    :NEXT                          :rem 209
280 PRINTSPC(15)"{2 DOWN}{BLK}TO RESTART
                                    :rem 96
290 PRINTSPC(15)"{DOWN}PRESS '*' :rem 253
300 REM PRINT NAMES AND POKE PLAYER NUMBE
    R IF TWO PLAYERS               :rem 185
310 IFP=2THENPRINT"{HOME}{2 DOWN}{RVS}
    {CYN}"SPC(18)N1$:PRINT"{12 DOWN}{RVS}
    "SPC(18)N2$                    :rem 56
320 IFP=2THENPOKE1120,177:POKE1640,178
                                    :rem 208
330 REM LIGHT APPROPRIATE PLAYER NUMBER
                                    :rem 207
340 IFW=-1THENPOKE55392,6:POKE55912,1
                                    :rem 172
350 IFW=1THENPOKE55912,6:POKE55392,1
                                    :rem 128
360 REM RANDOM TONE STRING FORMATION
                                    :rem 250
370 R=INT(RND(1)*4)+1              :rem 133
380 S$=S$+STR$(R)                  :rem 177
390 GOSUB760                       :rem 185
400 REM VIC PLAYS IT'S STRING     :rem 209
410 FORL=2TOLEN(S$)STEP2          :rem 239
420 NT=VAL(MID$(S$,L,1))           :rem 68
430 FG=1:GOSUB630:FORA=1TO75/LV↑2:NEXT
                                    :rem 158
440 NEXT:POKE198,0                  :rem 62
450 REM PLAYER ATTEMPTS A MATCH   :rem 106
460 GETZ$:IFZ$=""THEN460          :rem 137
470 FORI=1TO4:IFZ$=MID$("{F1}{F3}{F5}{F7}
    ",I,1)THENNT=I:I=10            :rem 139
480 NEXT:IFI>10THENFG=1:GOSUB630:F$=F$+ST
    R$(NT):GOTO510                 :rem 152
490 IFZ$="*"THENRUN                :rem 121
500 REM PLAYER TONE STRING/VIC TONE STRIN
    G COMPARISON                   :rem 108
510 IFLEN(F$)<>LEN(S$)THEN460     :rem 169
520 IFF$=S$THEN570                  :rem 15
530 IFE=1THEN690                   :rem 168
540 IFE=0THENF$="":E=1:GOSUB760:PRINT"
    {HOME}{DOWN}"SPC(15)"{YEL}{RVS}TRY AG
    AIN":GOSUB740                  :rem 172
550 PRINT"{HOME}{DOWN}"SPC(15)"{9 SPACES}
    ":GOSUB750:POKE198,0:GOTO390   :rem 60
560 REM SCORING                   :rem 148
570 E=0:F$="":IFW=1THENS1=S1+1:IFH1<S1THE
    NH1=S1                         :rem 60
580 IFW=-1THENS2=S2+1:IFH2<S2THENH2=S2
                                    :rem 95
590 IFW=1THENPRINT"{HOME}{2 DOWN}{PUR}
    {RVS}HIGH{2 SPACES}:"H1:PRINT"{GRN}SC
    ORE :"S1                       :rem 11
600 IFW=-1THENPRINTLEFT$(D$,16)"{PUR}
    {RVS}HIGH{2 SPACES}:"H2:PRINT"{GRN}SC
    ORE :"S2                      :rem 152
610 GOSUB760:GOTO340              :rem 190
620 REM PLAY NOTES                 :rem 59
630 WF=32:IFFGTHENPRINTLEFT$(D$,NT*3+2)SP
    C(20)"{RVS}{WHT}{3 SPACES}":WF=16
                                    :rem 233
640 VC=VC+7:IFVC=21THENVC=0       :rem 162
650 POKES+VC+5,48:POKES+VC+6,170:POKES+VC
    ,L(NT):POKES+VC+1,H(NT)       :rem 172
660 POKES+VC+4,WF+1:GOSUB750:POKES+VC+4,W
    F                             :rem 100
670 IFFGTHENPRINTLEFT$(D$,NT*3+2)SPC(20)"
    {RVS}{GRN}{3 SPACES}{CYN}"    :rem 177
680 RETURN                        :rem 126
690 FG=0:NT=0:GOSUB630:GOSUB760:NT=2:GOSU
    B630:GOSUB760                 :rem 129
700 S1=0:S2=0:S$="":F$="":E=0     :rem 247
710 IFP=2THENW=-W:REM SWITCH PLAYERS
                                    :rem 61
720 GOTO340                       :rem 105
730 REM BUZZER/TIMING              :rem 87
740 FG=0:NT=2:GOSUB630:RETURN      :rem 77
750 IFFGTHENFORM=1TO600/LV↑2:NEXT:RETURN
                                    :rem 182
760 FORM=1TO400:NEXT:RETURN         :rem 9
770 DATA 21,31, 14,24, 15,210, 16,195, 18
    ,209                          :rem 217
```

Aardvark Attack

```
10 GOSUB800
12 GOSUB995
14 PRINT"{CLR}{2 DOWN} INSTRUCTIONS (Y/N
   )?"
15 GETG$:IFG$=""THEN15
16 IFG$="Y"THENGOSUB1200
18 PRINT"{CLR}{2 DOWN}{RVS}{3 SPACES}AAR
   DVARK ATTACK{4 SPACES}{OFF}{DOWN}
19 PRINT"{DOWN} ALPHANUMERIC WEAPONS
   {2 DOWN}"
20 PRINT"{2 DOWN}{4 SPACES}WHICH LEVEL?
   {7 SPACES}{DOWN}(1=EXPERT{3 SPACES}9=
   NOVICE)"
22 GETHF$:IFHF$=""THEN22
23 IF(HF$>"9"ORHF$<"1")THEN22
24 HF=INT(2.5↑(VAL(HF$)-1))
25 SC=0:GOSUB900
30 GOSUB925:REM **** NEW LETTER
32 FORI=0TO3:FORJ=0TO3:C(I,J)=0:NEXTJ:NE
   XTI:REM *** CLEAR OLD LETTER
40 L=INT(RND(1)*26+1):B=32768+L*8:F=0
45 FORI=0TO3
48 F=ABS(F-1)
50 T=PEEK(B+2*I+1-F)
53 FORJ=0TO3
55 M=(TANDFNM(J))/(4↑J):C(I,J)=C(I,J)+IN
   T(M*(4↑F))
58 NEXTJ
60 IFFTHEN48
63 NEXTI
70 REM **** FLASHING
72 X=INT(RND(1)*101+20)
```

```
74 FORY=1TOX:Z=INT(RND(1)*10):ZZ=7682+Z:
   POKEZZ,32:POKEZZ,160:NEXTY
80 POKE36879,27:SYS828
82 FORI=0TO3:FORJ=0TO3
84 P=7722-J+22*I:Q=S(C(I,J)):POKEP,Q
86 NEXTJ:NEXTI
90 LF=0:NF=0:FH=0:SH=0:SYS833:POKE7680,L
98 POKEZZ,32
99 REM *** START ATTACK
100 FORX=1TO18
105 GETG$:IFG$=""THENFORY=1TOHF:NEXTY:GO
   TO190
110 IFLFTHEN140
120 IF(ASC(G$)-64)=LTHENLF=1:FH=X:GOTO14
   0
130 FORY=1TOHF:NEXTY:GOTO190
140 IFNFTHEN300
150 IF(VAL(G$)-1)=ZTHEN180
160 IF(G$="0"ANDZ=9)THEN180
170 FORY=1TOHF:NEXTY:GOTO190
180 NF=1:SH=X:GOTO300
190 POKE(7682+Z+X*22),81+LF*128:POKE(384
   02+Z+X*22),0
200 NEXTX
210 REM *** LOSE ROUND
220 FORXX=0TO3
221 PB=(8100+Z+(22*XX))
222 IF(PEEK(PB)<>32)THEN240
223 NEXTXX
230 GOTO 320
240 IFLFTHEN260
250 POKE(PB+22),32
260 POKEPB,32
280 GOTO30:REM *** NEXT LETTER
299 REM *** SCORING
300 SC=SC+INT((500-5*FH-2*SH)/SQR(HF)):G
   OTO30
319 REM *** LOSE ROUTINE
320 FORY=1TO300:NEXT:PRINT"{CLR}********
   **************{DOWN} SORRY, YOU LOST
   ."
321 PRINT"{2 DOWN} YOUR SCORE:";SC
322 PRINT"{DOWN} AT LEVEL ";HF$
323 PRINT"{2 DOWN} PLAY AGAIN (Y/N)?"
324 GETY$:IFY$=""THEN324
326 IFY$="N"THENPRINT"{CLR}":END
328 GOTO18
800 DIMS(15):DIMC(3,3)
801 REM *** HOUSEKEEPING
805 DEFFNM(X)=3*(4↑X)
810 FORX=0TO15:READS(X):NEXT
815 DATA32,108,123,98,124,225,255,254
820 DATA126,127,97,252,226,251,236,160
825 RETURN
898 END
899 REM *** SCREENS
900 PRINT"{CLR}{2 SPACES}**********
   {3 SPACES}{HOME}{DOWN}":FORX=1TO110:
   PRINT" ";:NEXT
910 PRINT"{HOME}{19 DOWN}{2 SPACES}12345
   67890{5 SPACES}L ";HF$;" ";
920 FORX=1TO3:PRINT"{2 SPACES}{Q}{RVS}
   {10 SPACES}{OFF}{W}{3 SPACES}
   {5 +}";:NEXT
925 PRINT"{HOME} {Q}**********{W}";
930 FORX=7696TO7806STEP22:FORY=0TO5:POKE
   X+Y,102:NEXTY:NEXTX
940 FORX=7719TO7785STEP22:FORY=0TO3:POKE
   X+Y,160:NEXTY:NEXTX
950 FORX=38400TO38531:POKEX,6:NEXT:FORX=
   0TO17:FORY=0TO9:POKE(7704+Y+X*22),32
   :NEXTY,X
955 FORX=7681TO8165STEP22:POKEX,107:POKE
   X+11,115:POKEX+30720,6:POKEX+30731,6
   :NEXTX
960 PRINT"{HOME}{14 DOWN}{16 RIGHT}SCORE
   ";
961 PRINT"{HOME}{15 DOWN}{15 RIGHT}";SC;
970 RETURN
994 END:REM *** 828&33 SYS
995 FORX=828TO867:READY:POKEX,Y:NEXT
999 RETURN
1000 DATA169,1,76,67,3,169,6,160
1001 DATA39,140,77,3,162,0,160,0
1002 DATA157,39,150,232,224,4,208,248
1003 DATA238,77,3,200,192,22,208,248
1004 DATA172,77,3,192,127,208,229,96
1200 REM *** INSTRUCTIONS
1210 PRINT"{CLR}{DOWN} {20 +} {DOWN} A
   NDROMEDAN AARDVARKS{2 SPACES}ARE AT
   TACKING EARTH."
1220 PRINT"{DOWN} THEY HAVE 26 KINDS
   {4 SPACES}OF BOMBS AND THEY'RE
   {2 SPACES}ATTACKING 10 CITIES!"
1230 PRINT"{DOWN} YOUR ALPHANUMERIC
   {5 SPACES}RADAR CAN SAVE EARTH."
1240 PRINT" FIRST: RECOGNIZE{13 SPACES}T
   HE BOMB (A-Z)"
1250 PRINT"{2 SPACES}THEN: SAVE
   {18 SPACES}THE CITY (0-9)"
1260 PRINT"{DOWN} {RVS}HIT ANY KEY TO PL
   AY{OFF}";
1270 GETG$:IFG$=""THEN1270
1280 RETURN
```

Word Match

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs" and "A Beginner's Guide To Typing In Programs" that appear before the Program Listings. Also, see the article "Automatic Proofreader."

Program 1: VIC Word Match

```
1 REM WORD MATCH
2 PRINT"{CLR}"SPC(247)"{PUR}WORD MATCH"
3 FORP=1TO2E3:NEXT:PRINTSPC(67)"{BLU}TOU
  CH A KEY..."
4 GETA$:IFA$=""THEN4
10 DIMN$(2):PRINT"{BLU}{CLR}NAMES, PLEAS
   E!"
12 PRINT"{HOME}{15 DOWN}TO PLAY AGAINST
   THE{4 SPACES}COMPUTER, ENTER
   {SHIFT-SPACE}'VIC' AS A PLAYER."
13 PRINT"{HOME}{DOWN}":FORN=1TO2:PRINT"
   {DOWN}PLAYER"N;:INPUTN$(N):NEXT:PRINT
   "{CLR}"
20 S=36876:V=S+2:BK=V+1:POKES,0:POKEV,15
   :POKEBK,156:O=30720
30 DIMW$(12),R%(28),W1$(6),C%(2),SQ%(12)
   ,BK%(2)
32 DATACAR,CAT,BOY,HAT,HIT,TOP,ATE,EAT,P
   IT,PAT,GOT,HIM,HER,WHY,HOW,TIN,ILL,WH
   O,RUN,YOU
33 DATAACE,BED,INK,AIM,ART,TOT,TIE,END
```

```
35 FORN=1TO28
36 Z=INT(RND(1)*28)+1:IFR%(Z)<>0THEN36
37 R%(Z)=N:NEXT
38 FORN=1TO6:FORQ=1TOR%(N):READW$:NEXT:W
   1$(N)=W$:RESTORE:NEXT:FORQ=1TO28:READ
   W$:NEXT
39 C%(1)=2:C%(2)=5:BK%(1)=172:BK%(2)=236
40 FORN=1TO12:R%(N)=0:NEXT
41 FORN=1TO11STEP2
42 Z=INT(RND(1)*12)+1:Y=INT(RND(1)*12)+1
43 IFR%(Z)<>0ORR%(Y)<>0ORZ=YTHEN42
44 R%(Z)=N:R%(Y)=N+1
45 NEXT
47 FORN=1TO12:R%(N)=INT((R%(N)-1)/2)+1:W
   $(N)=W1$(R%(N)):NEXT
50 FORN=1TO4
51 PRINT"{BLK} {RVS}{19 SPACES}"
52 FORZ=1TO3
53 PRINT" {RVS} {OFF}{5 SPACES}{RVS}
   {OFF}{5 SPACES}{RVS} {OFF}{5 SPACES}
   {RVS} {OFF}"
54 NEXTZ,N
55 PRINT" {RVS}{19 SPACES}"
56 PRINT"{HOME}{2 DOWN}{PUR}"
60 FORN=1TO9STEP3
62 PRINTTAB(3)NSPC(3)N+1SPC(3)N+2
64 PRINT"{2 DOWN}":NEXT
66 PRINT"{4 RIGHT}10{4 RIGHT}11{4 RIGHT}
   12"
70 D$="{HOME}{18 DOWN}"
71 SP$="{21 SPACES}"
74 PRINTD$SP$SP$
80 FORN=1TO12:READSQ%(N):NEXT
81 DATA7726,7732,7738,7814,7820,7826,790
   2,7908,7914,7990,7996,8002
100 REM GAME
105 X=1
110 PRINTD$"{RED}WHICH BLOCKS, "N$(X)"?"
115 POKEBK,BK%(X)
117 IFN$(X)="VIC"THENGOSUB1000
120 PRINTD$"{DOWN}"SP$D$"{DOWN}{PUR}
    {RVS}BLOCK A?{BLK}{OFF}";
121 GETA$:IFA$=CHR$(13)THENI=VAL(AN$):AN
    $="":GOSUB400:ON(I>12)+2GOTO120,124
122 IFA$<"0"ORA$>"9"THEN121
123 PRINTA$;:AN$=AN$+A$:GOTO121
124 ON(R%(I)=0)+2GOTO120,132
125 PRINTD$"{2 DOWN}"SP$D$"{2 DOWN}{BLU}
    {RVS}BLOCK B?{BLK}{OFF}";:
126 GETA$:IFA$=CHR$(13)THENJ=VAL(AN$):AN
    $="":GOSUB400:ON(J>12)+2GOTO125,129
127 IFA$<"0"ORA$>"9"THEN126
128 PRINTA$;:AN$=AN$+A$:GOTO126
129 ON(R%(J)=0)+2GOTO125,130
130 IFI=JTHEN125
131 PRINTD$SP$SP$SP$SP$;:GOTO137
132 FORN=1TO3
135 POKESQ%(I)+N+22+O,6:POKESQ%(I)+N+22,
    ASC(MID$(W$(I),N,1))-64:NEXT
136 ON(N$(X)="VIC")+2GOTO1040,125
137 FORN=1TO3
138 POKESQ%(J)+N+22+O,6:POKESQ%(J)+N+22,
    ASC(MID$(W$(J),N,1))-64
139 NEXT
140 IFR%(I)=R%(J)THEN200
150 PRINTD$SP$D$TAB(6)"{RED}{RVS}NO MATC
    H-{OFF}"
151 FORN=1TO30:POKES,240:POKES,240-3*N:N
    EXT:POKES,0
152 FORP=1TO2E3:NEXT:PRINTD$SP$
153 I$=STR$(I):I$=RIGHT$(I$,LEN(I$)-1):J
    $=STR$(J):J$=RIGHT$(J$,LEN(J$)-1)
154 POKESQ%(I)+23,32:POKESQ%(J)+23,32:PO
    KESQ%(I)+25,32:POKESQ%(J)+25,32
155 FORN=1TOLEN(I$):POKESQ%(I)+23+N,ASC(
    MID$(I$,N,1)):POKESQ%(I)+23+N+O,4:NE
    XT
156 FORN=1TOLEN(J$):POKESQ%(J)+23+N,ASC(
    MID$(J$,N,1)):POKESQ%(J)+23+N+O,4:NE
    XT
160 IFX=1THENX=2:GOTO110
162 X=1:GOTO110
200 REM RIGHTANS
205 PRINTD$SP$SP$D$"{6 SPACES}{BLK}{PUR}
    {RVS}MATCH!!!!{OFF}"
210 FORN=1TO5:FORZ=200TO240:POKES,Z:NEXT
    Z,N:POKES,0
211 IFX=1THENS1=S1+1
212 IFX=2THENS2=S2+1
215 FORP=1TO2E3:NEXT
220 Q=SQ%(I):R=SQ%(J)
225 FORN=1TO3
230 FORW=QTOQ+4:POKEW+O,C%(X):POKEW,160:
    NEXT:Q=Q+22:NEXT
231 FORN=1TO3
232 FORW=RTOR+4:POKEW+O,C%(X):POKEW,160:
    NEXT:R=R+22:NEXT
235 PRINTD$SP$
237 CR=CR+1:IFCR=6THEN300
238 R%(I)=0:R%(J)=0
240 GOTO110
300 FORN=1TO5:FORZ=250TO150STEP-2:POKES,
    Z:NEXTZ,N:POKES,0
305 PRINTD$"THE GAME IS OVER-
306 FORP=1TO2E3:NEXT
307 IFS1>S2THENPRINTD$SP$D$N$(1)" WINS!!
    !"
308 IFS2>S1THENPRINTD$SP$D$N$(2)" WINS!!
    !"
309 IFS2=S1THENPRINTD$SP$D$"IT'S A TIE!!
    !"
310 FORP=1TO2E3:NEXT:PRINTD$"{DOWN}WANT
    ANOTHER?(Y/N)"
311 GETA$:IFA$="N"THENPRINT"{CLR}{BLU}":
    POKEBK,27:END
312 IFA$="Y"THENRUN10
314 GOTO311
400 POKES,249:FORP=1TO20:NEXT:POKES,0:RE
    TURN
1000 REM VIC PLAYS
1005 I=INT(RND(1)*12)+1:ON(R%(I)=0)+2GOT
     O1005,132
1040 J=INT(RND(1)*12)+1:IFJ=ITHEN1040
1050 IFR%(J)=0THEN1040
1060 PRINTD$SP$D$"VIC PICKS"I"AND"J"
     {LEFT}."
1065 FORP=1TO2E3:NEXT:GOTO137
```

Program 2: 64 Word Match

```
100 POKE53281,1:PRINT"{CLR}"SPC(250)"
    {BLK}{2 SPACES}WORD MATCH "
110 FORP=1TO2E3:NEXT:PRINTSPC(90)"{BLU}
    {2 SPACES}TOUCH A KEY..."
120 GETA$:IFA$=""THEN120
130 DIMN$(2):PRINT"{BLU}{CLR}NAMES, PLEA
    SE!"
140 PRINT"{HOME}{15 DOWN}TO PLAY AGAINST
```

```
     THE COMPUTER,"
145 PRINT"ENTER '64' AS PLAYER TWO"
150 PRINT"{HOME}{DOWN}":FORN=1TO2:PRINT"
    {DOWN}PLAYER"N;:INPUTN$(N):NEXT:PRIN
    T"{CLR}"
160 O=54272
161 S=54272:FORE=STOS+28:POKEE,0:NEXT
162 POKE54296, 15 :POKE54277, 66 :POKE54
    278, 210
163 POKE 54276, 17 :POKE 54272, 63
164 J=20:FORT=1TO 200:POKE54273,J:J=RND(
    0)*150+1:NEXT:POKE54276,16
165 FORT=1TO200:NEXT
170 DIMW$(12),R%(28),W1$(6),C%(2),SQ%(12
    ),BK%(2)
180 DATACAR,CAT,BOY,HAT,HIT,TOP,ATE,EAT,
    PIT,PAT,GOT,HIM,HER,WHY,HOW,TIN,ILL,
    WHO,RUN,YOU
190 DATAACE,BED,INK,AIM,ART,TOT,TIE,END
200 FORN=1TO28
210 Z=INT(RND(1)*28)+1:IFR%(Z)<>0THEN210
220 R%(Z)=N:NEXT
230 FORN=1TO6:FORQ=1TOR%(N):READW$:NEXT:
    W1$(N)=W$:RESTORE:NEXT:FORQ=1TO28:RE
    ADW$:NEXT
240 C%(1)=2:C%(2)=5:BK%(1)=172:BK%(2)=23
    6
250 FORN=1TO12:R%(N)=0:NEXT
260 FORN=1TO11STEP2
270 Z=INT(RND(1)*12)+1:Y=INT(RND(1)*12)+
    1
280 IFR%(Z)<>0ORR%(Y)<>0ORZ=YTHEN270
290 R%(Z)=N:R%(Y)=N+1
300 NEXT
310 FORN=1TO12:R%(N)=INT((R%(N)-1)/2)+1:
    W$(N)=W1$(R%(N)):NEXT
320 FORN=1TO4
330 PRINT"{BLK} {RVS}{31 SPACES}"
340 FORZ=1TO3
350 PRINT" {RVS} {OFF}{9 SPACES}{RVS}
    {OFF}{9 SPACES}{RVS} {OFF}{9 SPACES}
    {RVS} {OFF}"
360 NEXTZ,N
370 PRINT" {RVS}{31 SPACES}"
380 PRINT"{HOME}{2 DOWN}{PUR}"
390 FORN=1TO9STEP3
400 PRINTTAB(5)NSPC(7)N+1SPC(7)N+2
410 PRINT"{2 DOWN}":NEXT
420 PRINT"{6 RIGHT}10{8 RIGHT}11
    {8 RIGHT}12"
430 D$="{HOME}{18 DOWN}"
440 SP$="{39 SPACES}"
450 PRINTD$SP$SP$
460 FORN=1TO12:READSQ%(N):NEXT
470 DATA 1108, 1118 ,1128, 1268 ,1278, 1
    288 ,1428 ,1438 ,1448, 1588 ,1598 ,
    1608
480 REM GAME
490 X=1
500 PRINTD$"{RED}WHICH BLOCKS, "N$(X)"?"
510 POKEBK,BK%(X)
520 IFN$(X)="64"THENGOSUB1070
530 PRINTD$"{DOWN}"SP$D$"{DOWN}{PUR}
    {RVS}BLOCK A?{BLK}{OFF}";
540 GETA$:IFA$=CHR$(13)THENI=VAL(AN$):AN
    $="":GOSUB1060:ON(I>12)+2GOTO530,570
550 IFA$<"0"ORA$>"9"THEN540
560 PRINTA$;:AN$=AN$+A$:GOTO540
570 ON(R%(I)=0)+2GOTO530,650
580 PRINTD$"{2 DOWN}"SP$D$"{2 DOWN}{BLU}
    {RVS}BLOCK B?{BLK}{OFF}";:
590 GETA$:IFA$=CHR$(13)THENJ=VAL(AN$):AN
    $="":GOSUB1060:ON(J>12)+2GOTO580,620
600 IFA$<"0"ORA$>"9"THEN590
610 PRINTA$;:AN$=AN$+A$:GOTO590
620 ON(R%(J)=0)+2GOTO580,630
630 IFI=JTHEN580
640 PRINTD$SP$SP$SP$SP$;:GOTO680
650 FORN=1TO3
660 POKESQ%(I)+N+40+O,6:POKESQ%(I)+N+40,
    ASC(MID$(W$(I),N,1))-64:NEXT
670 ON(N$(X)="64")+2GOTO1090,580
680 FORN=1TO3
690 POKESQ%(J)+N+40+O,6:POKESQ%(J)+N+40,
    ASC(MID$(W$(J),N,1))-64
700 NEXT
710 IFR%(I)=R%(J)THEN810
720 PRINTD$SP$D$TAB(12)"{RED}{RVS}NO MAT
    CH-{OFF}"
730 REM NO MATCH
731 S=54272:FORE=STOS+28:POKEE,0:NEXT
732 POKE54296, 15 :POKE54277, 51 :POKE54
    278, 164
733 POKE54275, 8 :POKE54274, 100
734 POKE 54273, 2 :POKE54272, 135 :POKE5
    4276, 65
735 FORT=1TO 200 :NEXT:POKE54276, 64
740 FORP=1TO2E3:NEXT:PRINTD$SP$
750 I$=STR$(I):I$=RIGHT$(I$,LEN(I$)-1):J
    $=STR$(J):J$=RIGHT$(J$,LEN(J$)-1)
760 POKESQ%(I)+41,32:POKESQ%(J)+41,32:PO
    KESQ%(I)+43,32:POKESQ%(J)+43,32
770 FORN=1TOLEN(I$):POKESQ%(I)+41+N,ASC(
    MID$(I$,N,1)):POKESQ%(I)+41+N+O,4:NE
    XT
780 FORN=1TOLEN(J$):POKESQ%(J)+41+N,ASC(
    MID$(J$,N,1)):POKESQ%(J)+41+N+O,4:NE
    XT
790 IFX=1THENX=2:GOTO500
800 X=1:GOTO500
810 REM RIGHTANS
820 PRINTD$SP$SP$D$"{12 SPACES}{BLK}
    {PUR}{RVS}MATCH!!!!{OFF}"
830 REM MATCH!!
831 S=54272:FORE=STOS+28:POKEE,0:NEXT
832 POKE54296, 10 :POKE54277, 35 :POKE54
    278,163
833 POKE 54273, 33 :POKE54272, 135 :POKE
    54276,17
834 FORT=1TO 100 :NEXT
835 POKE 54273, 42 :POKE54272, 62
    {2 SPACES}:POKE54276,17
836 FORT=1TO 100 :NEXT
837 POKE 54273,50{2 SPACES}:POKE54272, 6
    0{2 SPACES}:POKE54276,17
838 FORT=1TO 600 :NEXT:POKE54276, 16
840 IFX=1THENS1=S1+1
850 IFX=2THENS2=S2+1
860 FORP=1TO2E3:NEXT
870 Q=SQ%(I):R=SQ%(J)
880 FORN=1TO3
890 FORW=Q-2TOQ+6:POKEW+O,C%(X):POKEW,16
    0:NEXT:Q=Q+40:NEXT
900 FORN=1TO3
910 FORW=R-2TOR+6:POKEW+O,C%(X):POKEW,16
    0:NEXT:R=R+40:NEXT
920 PRINTD$SP$
930 CR=CR+1:IFCR=6THEN960
```

```
940 R%(I)=0:R%(J)=0
950 GOTO500
960 FORN=1TO5:FORZ=250TO150STEP-2:POKES,
    Z:NEXTZ,N:POKES,0
970 PRINTD$"THE GAME IS OVER-
980 FORP=1TO2E3:NEXT
990 IFS1>S2THENPRINTD$SP$D$N$(1)" WINS!!
    !"
1000 IFS2>S1THENPRINTD$SP$D$N$(2)" WINS!
     !!"
1010 IFS2=S1THENPRINTD$SP$D$"IT'S A TIE!
     !!"
1020 FORP=1TO2E3:NEXT:PRINTD$"{DOWN}WANT
      ANOTHER?(Y/N)"
1030 GETA$:IFA$="N"THENPRINT"{CLR}{BLU}"
     :POKEBK,27:END
1040 IFA$="Y"THENRUN130
1050 GOTO1030
1060 REM SOUND FOR BEGINNING
1061 S=54272:FORE=STOS+28:POKEE,0:NEXT
1062 POKE54296, 15 :POKE54277, 51 :POKE5
     4278, 246
1063 POKE 54276,17{2 SPACES}:POKE 54273,
      1{2 SPACES}:POKE54272, 135
1064 FORT=1TO200STEP16{2 SPACES}: POKE54
     273,T/2+50:NEXT:POKE54276,16:FORT=1
     TO 500 :NEXT
1065 RETURN
1070 REM C-64 PLAYS
1080 I=INT(RND(1)*12)+1:ON(R%(I)=0)+2GOT
     O1080,650
1090 J=INT(RND(1)*12)+1:IFJ=ITHEN1090
1100 IFR%(J)=0THEN1090
1110 PRINTD$SP$D$"64 PICKS"I"AND"J"
     {LEFT}."
1120 FORP=1TO2E3:NEXT:GOTO680
```

Understanding Sound

BEFORE TYPING...

Before typing in programs, please refer to "How To Type COMPUTE!'s Gazette Programs" and "A Beginner's Guide To Typing In Programs" that appear before the Program Listings. Also, see the article "Automatic Proofreader."

Program 1:

Demonstration Of The ADSR Envelope

```
5 PRINT"{CLR}":POKE53281,12:POKE646,0
10 PRINTTAB(8)CHR$(18)CHR$(169)CHR$(223)"
   {OFF} "
20 PRINTTAB(7)CHR$(18)CHR$(169)"
   {2 SPACES}"CHR$(223)
30 PRINTTAB(6)CHR$(18)CHR$(169)"
   {4 SPACES}"CHR$(223)
40 PRINTTAB(5)CHR$(18)CHR$(169)"
   {6 SPACES}"CHR$(223)
50 PRINTTAB(4)CHR$(18)CHR$(169)"
   {19 SPACES}"CHR$(223)
60 PRINTTAB(3)CHR$(18)CHR$(169)"
   {21 SPACES}"CHR$(223)
70 PRINTTAB(2)CHR$(18)CHR$(169)"
   {23 SPACES}"CHR$(223)
80 PRINTTAB(1)CHR$(18)CHR$(169)"
   {25 SPACES}"CHR$(223)
90 PRINT
100 PRINT"{4 SPACES}A{5 SPACES}D
    {3 SPACES}SUSTAIN{4 SPACES}R
110 PRINT"{4 SPACES}T{5 SPACES}E
    {14 SPACES}E
120 PRINT"{4 SPACES}T{5 SPACES}C
    {14 SPACES}L
130 PRINT"{4 SPACES}A{5 SPACES}A
    {14 SPACES}E
140 PRINT"{4 SPACES}C{5 SPACES}Y
    {14 SPACES}A
150 PRINT"{4 SPACES}K{20 SPACES}S
160 PRINT"{25 SPACES}E
170 CL=55296:S=54272:W=S+4:AD=S+5:SR=S+6
    :V=S+24
175 POKEV,15:POKEAD,202:POKESR,58:POKES,
    135:POKES+1,33:POKEW,33
180 FORR=CLTOCL+5:FORU=RTOCL+1024STEP40:
185 POKEU,1:NEXT:NEXT
190 FORR=CL+6TOCL+12:FORU=RTOCL+1024STEP
    40
195 POKEU,1:NEXT:NEXT
197 FORR=CL+13TOCL+23:FORU=RTOCL+1024STE
    P40
198 POKEU,1:NEXT:NEXT
200 POKEW,16:FORR=CL+24TOCL+28:FORU=RTOC
    L+1024STEP40
290 POKEU,1:NEXT:NEXT
300 FORT=STOS+28:POKET,0:NEXT
```

Program 2:

Demonstration Of Waveforms, Pitches, And The Envelope Generator

```
5 POKE53281,1:POKE646,0
10 S=54272:FORE=STOS+28:POKEE,0:NEXT
15 PRINT"{CLR}{UP}":GOSUB200
20 INPUT"ATTACK RATE 0-15";AT:INPUT"DECA
   Y RATE 0-15";DE:AD=16*AT+DE:POKE54277
   ,AD
25 INPUT"SUSTAIN{SHIFT-SPACE}VOLUME 1-15
   ";SU:INPUT"RELEASE RATE 0-15";RL:J=16
   *SU+RL
30 POKE54278,J:INPUT"OVERALL VOLUME 1-15
   ";V:POKE54296,V
32 INPUT"WAVEFORM 17,33,OR 129 ";W:POKE5
   4276,W
33 INPUT"SUSTAIN LENGTH (* .1 SECOND)";L
   E:LE=LE*100
34 INPUT"RELEASE LENGTH (* .1 SECOND)";D
   L:DL=DL*100
35 INPUT"HIGH BYTE";H:INPUT"LOW BYTE";L:
   POKE54273,H :POKE54272,L
40 FORT=1TOLE:NEXTT
42 POKE54276,(W-1)
43 FORT=1TODL:NEXT
50 S=54272:FORE=STOS+28:POKEE,0:NEXT
60 PRINT"{HOME}{13 DOWN}{RVS}AGAIN?{OFF}
    Y OR N"
70 GETA$:IFA$="Y"THENPRINT"{HOME}
   {13 DOWN}{16 SPACES}":GOTO20
75 IFA$<>"N"THEN70
80 REM PRINT PROGRAM
85 INPUT"{CLR}STARTING LINE";SL:INPUT"IN
   CREMENT";IN
86 PRINT"{CLR}"
88 PRINT"{3 DOWN}NEW{3 DOWN}"
89 PRINTSL;"S=54272:FORE=STOS+28:POKEE,0
   :NEXT":SL=SL+IN
90 PRINTSL;"POKE54296,";V;":POKE54277,";
```

```
AD;":POKE54278,";J:SL=SL+IN
120 PRINTSL;"POKE 54276,";W;":POKE 54273
    ,";H;":POKE54272,";L:SL=SL+IN
140 PRINTSL;"FORT=1TO";LE;":NEXT";":POKE
    54276,";(W-1);"{LEFT}:FORT=1TO";DL;"
    :NEXT"
150 SL=SL+IN:PRINTSL;"FORE=STOS+28:POKEE
    ,0:NEXT
155 PRINT"{HOME}";:FORR=631TO644:POKER,1
    3:NEXT
160 POKE198,13
165 END
200 PRINT" SAMPLE DATA FOR PITCH VALUES"
205 PRINT" PITCH HIGH BYTE LOW BYTE
    {2 SPACES}{RVS}WAVEFORMS
210 PRINT"{3 SPACES}C{7 SPACES}33
    {6 SPACES}135{5 SPACES}TRIANGLE=17
220 PRINT"{3 SPACES}C#{6 SPACES}35
    {6 SPACES}134{5 SPACES}SAWTOOTH=33
230 PRINT"{3 SPACES}D{7 SPACES}37
    {6 SPACES}162{5 SPACES}NOISE=129
240 PRINT"{3 SPACES}D#{6 SPACES}39
    {6 SPACES}223
250 PRINT"{3 SPACES}E{7 SPACES}42
    {6 SPACES}62
260 PRINT"{3 SPACES}F{7 SPACES}44
    {6 SPACES}193
270 PRINT"{3 SPACES}F#{6 SPACES}47
    {6 SPACES}107
280 PRINT"{3 SPACES}G{7 SPACES}50
    {6 SPACES}60
290 PRINT"{3 SPACES}G#{6 SPACES}53
    {6 SPACES}57
300 PRINT"{3 SPACES}A{7 SPACES}56
    {6 SPACES}99
310 PRINT"{3 SPACES}A#{6 SPACES}59
    {6 SPACES}190
320 PRINT"{3 SPACES}B{7 SPACES}63
    {6 SPACES}75
335 PRINT
340 RETURN
```

Speeding Up The VIC

Program 1: BASIC Loader

```
59998 FORA=828TO848:READB:POKEA,B:NEXT:E
      ND
59999 DATA120,169,73,141,20,3,169,3,141,
      21,3,88,96,169,0,141,140,2,76,191,
      234
```

Program 2: Location Modifier

```
59997 FORA=828TO853:READB:POKEA,B:NEXT:E
      ND
59998 DATA120,169,73,141,20,3,169,3,141,
      21,3,88,96,169,1,141,139,2,169,0,1
      41,140,2,76
59999 DATA191,234
```

Program 3: Ball Character Movement

```
59997 FORA=828TO853:READB:POKEA,B:NEXT:E
      ND
59998 DATA120,169,73,141,20,3,169,3,141,
      21,3,88,96,169,1,141,139,2,169,0,1
      41,140,2,76
59999 DATA191,234
```

```
60000 A=7680:B=38400:C=8185:E=A:F=38905:
      G=B:H=81:I=32:POKE650,128:SYS828:P
      RINT"{CLR}":D=1
60010 GETA$:IFA$="R"THEND=1:GOTO60060
60020 IFA$="W"THEND=-1:GOTO60060
60030 IFA$="*"THEND=22:GOTO60060
60040 IFA$="P"THEND=-22:GOTO60060
60050 IFD=0THEN60010
60060 POKEA,I:A=A+D:B=B+D:POKEA,H:POKEB,
      6:D=0
60070 IFA<ETHENA=C:B=F:GOTO60060
60080 IFA>CTHENA=E:B=G:GOTO60060
60090 GOTO60010
```

Power BASIC

Program 1: VIC Paddle Reader

```
10 FORA=828TO859:READB:POKEA,B:NEXT
828 DATA 169,0,170,168,24,109,8,144
836 DATA 144,1,200,202,208,247,132,251
844 DATA 138,168,24,109,9,144,144,1
852 DATA 200,202,208,247,132,252,96,0
```

Program 2: 64 Paddle Reader

```
10 FORA=679TO710:READB:POKEA,B:NEXT
679 DATA 169,0,170,168,24,109,25
686 DATA 212,144,1,200,202,208,247
693 DATA 132,251,138,168,24,109,26
700 DATA 212,144,1,200,202,208,247
707 DATA 132,252,96,256
```

The Beginner's Corner

Math Competency: Saving Money

```
10 REM MATH COMPETENCY                :rem 102
20 REM SAVING MONEY                   :rem 150
30 PRINT"{CLR}{BLU}"                  :rem 230
40 FOR C=1 TO 6                       :rem 213
50 READ N$(C)                         :rem 135
60 NEXT C                             :rem 232
70 FOR C=1 TO 3                       :rem 213
80 READ A$(C),B(C),M(C),F(C)          :rem 146
90 NEXT C                             :rem 235
100 DATA SALLY,HEIDI,NANCY,BRENT,DAVID,CH
    UCK                               :rem 57
110 DATA BIKE,80,5,7,STEREO,90,5,14,COMPU
    TER,100,10,10                     :rem 22
120 PRINT"{CLR}{BLU}"                 :rem 22
130 R6=INT(6*RND(0)+1)                :rem 182
140 PRINT N$(R6);" WANTS TO BUY A":rem 77
150 R3=INT(3*RND(0)+1)                :rem 178
160 PRINT A$(R3);"."                  :rem 12
170 T=B(3)+M(R3)*INT(F(R3)*RND(0)+1)
                                      :rem 170
180 GOSUB 480                         :rem 181
190 PRINT"IT WILL COST ";C$;"."       :rem 200
200 P$="HE"                           :rem 20
210 IF R6>=4 THEN 230                 :rem 29
220 P$="SHE"                          :rem 105
230 W=10*INT(4*RND(0)+1)              :rem 15
240 PRINT"IF ";P$;" SAVES FOR"        :rem 141
245 PRINTW;"WEEKS,"                   :rem 169
250 PRINT"HOW MUCH WILL ";N$(R6)" :rem 99
```

```
260 PRINT"NEED TO SAVE EACH"      :rem 104
265 PRINT"WEEK?"                  :rem 217
270 PRINT"{BLK}"                  :rem 250
280 S=(T/W)/100                    :rem 21
290 INPUT ANS                      :rem 13
300 IF ABS(ANS-S)<.01 THEN 380     :rem 64
310 PRINT"{RED}TOTAL COST ";C$    :rem 224
320 PRINT"DIVIDED BY";W;"WKS ="    :rem 61
330 GOSUB 470                     :rem 177
340 PRINTC$                       :rem 139
350 PRINT"{GRN}"                  :rem 135
360 INPUT "PRESS <RETURN>";E$     :rem 248
370 GOTO 120                      :rem 102
380 PRINT                          :rem 40
390 PRINT"{RED}CORRECT!"          :rem 188
400 PRINT                          :rem 33
410 PRINT"{BLK}ANOTHER PROBLEM?"   :rem 87
420 PRINT"(Y/N)"                  :rem 142
430 GET E$                        :rem 224
440 IF E$="Y" THEN 120             :rem 44
450 IF{2 SPACES}E$="N" THEN 520    :rem 38
460 GOTO 430                      :rem 106
470 T=S+.005                      :rem 109
480 T=INT(100*T)                  :rem 120
490 T$=STR$(T)                     :rem 20
500 C$="$"+LEFT$(T$,LEN(T$)-2)+"."+RIGHT$
    (T$,2)                        :rem 168
510 RETURN                        :rem 118
520 PRINT"{CLR}{BLU}"              :rem 26
530 END                           :rem 111
```

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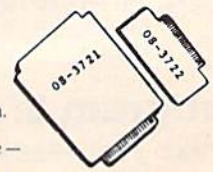

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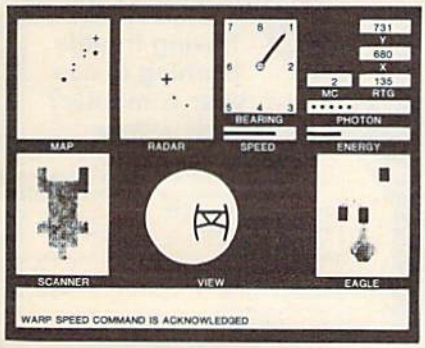

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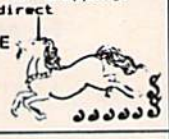

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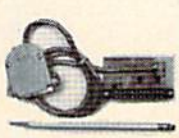

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ADVERTISERS INDEX

Reader Service Number/ Advertiser	Page
102 Aardvark L.T.D.	99
103 A-1 Services	62
Abacus Software	83
Abaris, Inc.	157
Accolade Computer Products	83
104 Advanced Processor Systems	97
AdVentures	31
Alphacom	29
American Peripherals	123
105 Animax Computer	66
Apropos Technology	115
Assembly Technology	129
106 Avalon Hill Game Company	45
107 Batteries Included	21
Bible Software	159
108 Boone	47
109 Broderbund Software	IFC
110 Byte-Ryte	129
111 Bytes & Pieces	158
112 Bytes & Pieces	105
113 Bytesize Micro Technology	159
114 Cardco, Inc.	IBC
Cass-A-Tapes	129
115 Century Micro Products	121
Chadwell's Software	157
Cheatsheet Products	157
116 Commercial Data Systems Ltd.	59
Commodore Business Machines	BC
Commodore 64 Users Group	156
Comm*Data Computer House, Inc.	81
Compatible Systems Incorporated	129
Compuscope	103
Computer Mail Order	69
117 Computer Marketing Services, Inc.	25
118 ComputerMat	63
119 Computer Outlet	93
Computer Outlet	156
Computer Place	100
120 CompuServe	37
121 ComStar	135
Creative Software	4
Cursor 64	20
Data Equipment Supply	78
122 Data 20	61
Data Impact Products, Inc.	95
DayProm Computer, Inc.	158
The Data Toolbox	158
123 Discount Software	158
Dytek	129
Eastern House	115
124 Family Computer Systems	159
Fantasy Computerware	158
Ferin Enterprises	157
Fleet Software	159
Foxfire Systems, Inc.	56
125 French Silk	103
Genesis Computer Corporation	73
Grapevine Software, Inc.	65
Hewitt's National Wholesale	116
House of Software	126
Human Engineered Software	19
126 Hytec Systems	41
Infocom	34,35
Interesting Software	109
Institutional Computer Development Corp.	82
127 Jini Micro-Systems, Inc.	139
128 Jay Sun Enterprizes, Incorporated	41
Jou Laboratories	159

Reader Service Number/Advertiser	Page
Lightning Software	107
129 Micol Systems	159
Micro Digital	75
Micro World Electronix, Inc.	104
130 Micro-80	104
Micro-Ware Distributing Inc.	46
Micro Software International Inc.	85
131 Micro Systems Development, Inc.	79
132 MicroTechniques	157
133 Midwest Micro Inc.	113
134 Mirage Concepts, Inc.	51
Mosaic Electronics, Inc.	78
Nüfekop	43
OJAI Software	159
Olympic Sales	130
Otto Systems	156
Parallel Systems	156
Phantom Software	57
Picture Perfect	157
Practical Applications	157
135 Professional Software Inc.	9
The Program Store	67
136 Protecto Enterprizes	89
Pro-Line Software	123
Pro-Line Software	130
137 Pyramid Software International	123
Quality Computer	46
Quicksilva Inc.	55
Rainbow Computer Corporation	87
138 R.I.S.T. Inc.	159
R J Software	156
Sierra On-Line, Inc.	7
Sierra On-Line, Inc.	71
SJB Distributors	119
Schoolmaster Programming Company	158
139 Skyles Electric Works	77
Software Guild	16,17
Sophware	129
Southern Solutions	121
140 Southwest Micro Systems, Inc.	92
Spinnaker	2,3
Sunsoft	20
141 Sydney Dataproducts, Inc.	53
142 Systems Management Associates	91
Synapse	15
143 T & F Software Company	1
144 Timeworks, Inc.	39
145 Toronto Pet Users Group	130
146 Total Information Services, Inc.	158
147 Totl Software, Inc.	113
Tri Micro	27
Tronix	11,12,13
148 Viasala	20
Valorum	159
149 Victory Software Corp.	73
The Video & Computer Place Inc.	157
150 Virginia Micro Systems	157
151 Voice World	121
152 Umbrella Software Incorporated	71
153 Ware It's At!	158
York 10 Computerware	73

COMPUTE!'s First Book of VIC	137
COMPUTE!'s First Book of VIC Games	33
COMPUTE!'s Gazette	49

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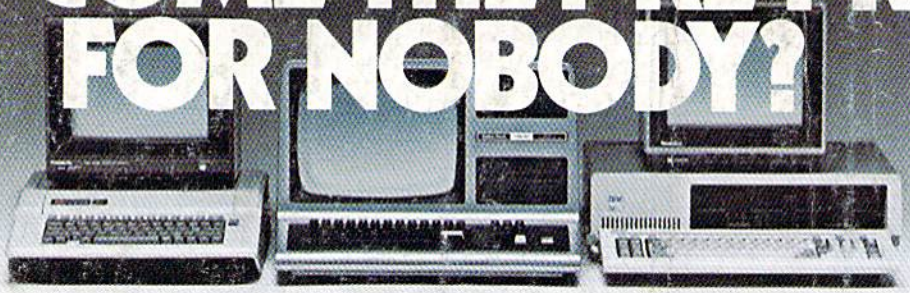

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